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PRESIDENTIAL ADDRESS

PASTURES IN THE AUSTRALIAN ECONOMY

By J. GRIFFITHS DAVIES

We can examine the importance of pastures in the Australian economy from two viewpoints. Firstly, their value in contributing to the national income, and secondly, their importance in the maintenance, development and expansion of the rural potential of the Commonwealth.

Pastures in the national income

Primary industry is recorded by the Commonwealth Statistician under several main headings—Agricultural, Pastoral, Dairying, Minerals, Forestry and Fisheries. In estimating the value of production from pastures it is necessary to adopt certain approximations since the income from pastures is all indirectly derived by sale of animals and animal products. There is, however, no way of estimating on a national scale the even less direct contribution of pastures to better crop production through increased soil fertility.

It has been difficult to determine what basis to adopt in taking from the statistician's records the data on which to make our estimates. Marked changes wrought by the war in the proportion of national income derived from primary industries and from factory production; wide fluctuations in prices in the past decade; the effect of price control on primary products are all factors which make recent statistics unreliable. The high wool prices of 1950-51 also produce a bias. For this discussion I have taken the year 1948-49—partly because I find that the ratio of primary to factory production is approximately equal, a position which seems to have been reached in the pre-war decade, partly because price controls had been eased and we had not yet reached the abnormally high wool prices later attained.

The "net value of production*" has been adopted as the best estimate for our purposes, and the data are summarised in Table I.

In estimating total income derived from pasture I have assumed that wool, meat, milk, cheese and trapping are wholly dependent on pasture. This is not strictly so because dairy animals are fed on fodder crops and receive cereals and concentrates derived from other crops. The contribution from fodder crops is not, however, very important even in dairy production because the estimated gross value of green fodder produced in 1948-49 was £3.6 million derived from 2 million acres.

*"Net value of production" is a standard statistic set out in the Primary Industry (and probably Secondary Industry) annual statistic summary of the Commonwealth Statistician. It is defined as "Net value represents the net return to the producer after deducting marketing and production costs from gross values, but depreciation and maintenance charges have not been deducted. Gross value is the value placed on recorded production at wholesale prices realised in the principal (Australian) market for the commodity." (Definitions adapted from Bull. No. 43, Commonwealth Bureau of Census and Statistics.)

J. GRIFFITHS DAVIES, Ph.D., is Associate Chief, Division of Plant Industry, C.S.I.R.O. *The above paper is based on his Presidential Address to the Australian Institute of Agricultural Science at its Eighteenth General Meeting held at Canberra on March 27, 1952.*

TABLE I

Net value of production 1948-49 *in million £.*

State	Agri-culture	Pastoral	Dairying	Trap-ping	Total Pasture	Total Primary	Total Factory	All Industries
N.S.W.	41.5	99.7	20.1	2.7	122.5	209.2	251.2	460.4
Vic.	36.0	51.9	22.3	3.8	88.0	128.7	182.8	311.5
Q'ld	27.5	46.2	16.5	0.2	62.9	100.0	53.5	153.6
S.A.	23.9	20.6	5.3	0.6	26.5	53.4	43.7	102.1
W.A.	18.5	20.8	2.1	0.3	24.2	50.8	21.2	72.0
Tas.	4.0	5.5	1.2	0.2	7.0	18.9	16.1	35.0
Australia	151.4	244.7	67.6	7.8	331.1	561.0	568.5	1130.6

From Table I, I have calculated the percentage contribution to net value of production from agricultural crops, from pastures, from all primary industry and from factories. These are given in Table II.

Thus we reach the interesting and significant conclusion that the products from pastures comprise 59 per cent. of all primary industry net value of production and that 29 per cent. of the net Australian production comes from pastures. This compares with 13 per cent. for all crops, 8 per cent. from mining, forestry, fisheries, poultry keeping and bee-farming combined. Mining accounts for 4 per cent. of the total.

These figures are for 1948-49 alone, but more arithmetic to cover a decade or several decades would not substantially change our conclusion, *viz.*, that the products from pasture are by far the most important contributors to the national wealth of Australia within the primary industries. It would be interesting to examine how much of our factory production income is derived from processing the animal products—wool, dairy products, meat and leather.

Pastures in the development of the Commonwealth

The second way of looking at the importance of pastures in Australia is to examine the use to which our continent is put at the present time and to examine potential development.

The total area of Australia is 2,974,000 sq. miles or approximately 1,903 million acres. Desert areas comprise about one-third of this total and this area can scarcely be regarded as of agricultural or pastoral value now or in the forseeable future. It will be if we ever can obtain irrigation water from sea-water.

A further third or so is semi-arid pastoral country of low or uncertain rainfall which already contributes, mainly in the form of wool and beef production a small proportion of our rural income. This vast area has already shown strong evidence of deterioration in stock carrying capacity and the only method of arresting this seems to be the reduction of

TABLE II

Percent. of net value contributed to national income.

	Agriculture	13.4%
	Pastures	29.3%
All	Primary Industry	49.6%
	Factories	50.4%

Pastures as percent. of all primary industry 59.0%

stocking rate and the control of the rabbit. This is a simple statement to make but it is extremely difficult to assess the impact of the grazing animal on these semi-arid communities. This is in part due to the low uncertain rainfall, the very light rates of stocking that can be imposed and the diversity both between and within the plant communities. There is no evidence to suggest that any economic method of improving the stock carrying capacity of these areas can be devised.

The remaining third of the continent is relatively well watered. The main contribution to our pastoral production comes from this area and the whole of our agriculture and dairying is carried on here. We can arrive at an estimate of this area by making certain broad assumptions.

In deriving Table III I have assumed that in Southern Australia the 15-inch isohyet virtually is the lower limit of agricultural development and of pasture improvement. This is not strictly so because already we have quite large acreages of wheat grown on land receiving less than 15 inches per annum. In Queensland I have taken the 20-inch isohyet as the lower limit, but this is probably an over-estimate within the tropics. In the Northern Territory and the north of Western Australia the 30-inch isohyet has been regarded as the lower limit. Perhaps even this is on the optimistic side. Accepting these limits we have a gross area of 900,000 square miles.

From this gross area must be deducted all the terrain too rough for agriculture, for pasture improvement or for forestry purposes. In addition we must deduct foreshores, rivers and lakes, city and town areas, roads, railways, as well as land needed for non-agricultural purposes such as water storage, aerodromes, mines and quarries. I have been unable to arrive at any real estimate of this aggregate area in each State. However, we might discount 20 per cent. or more of land as too rough or required for other purposes without changing the substance of the conclusions I shall bring.

In Table III I have examined the use to which the good rainfall areas of each state are now being put. For this discussion I must leave out the Northern Territory because we do not yet know what can be achieved in this region.

Certain outstanding conclusions can be derived from this table.

1. That even in the most highly developed State—Victoria—and allowing for a 20 per cent. deduction to cover land of no use in agriculture or for forestry, there still remains a total of 18,000,000

TABLE III

Gross area of reasonably well-watered land and its present use in each State. Average 10 years 1939-1949 except improved pastures which is the average of three years 1946-1948.*

State	Total	All Crops and Fallow	Forest	Improved Pasture	Residuum	Residuum less 20% of Total
N.S.W.	117,120	8,092	6,652	2,701	99,765	76,231
Vic.	43,520	6,569	4,939	5,027	26,985	18,281
Q'ld.	253,838	2,967	7,140	1,292	242,439	191,682
S.A.	21,024	5,288	253	703	14,780	10,575
W.A.	64,573	5,732	6,331	2,447	50,063	39,148
Tas.	15,000	383	2,124	603	11,890	6,890
Totals	515,075	29,031	27,439	12,773	445,832	342,808

*To nearest 1,000 acres.

acres of unimproved lands. That is, it is not used for good forests, for cropping nor have improved pastures been laid down. This compares with 16½ million already developed.

2. In New South Wales there are 76 million such acres.

3. That in Queensland we may have the staggering total of 190 million acres yet undeveloped.

Let us assume in Victoria and New South Wales that we could average one more sheep on each of these acres—it must be realised that a good deal of these areas are now carrying stock, much of it at ½ to 1 sheep per acre. If we make this assumption we could carry 94 million more sheep in New South Wales and Victoria. This compares with their present carrying capacity of 70 million sheep and 5½ million cattle for the entire area of the two states. I shall later suggest that there is evidence that we can achieve better results per acre than this.

Let us further assume that by improving the pastures in Queensland we could carry a cattle beast to each ten acres in addition to the present complement, then we would carry a further 19 million as against the 1948-49 total of approximately 6 million for that state.

How can we achieve such increments? The first question we have to answer is why is there such a large area of undeveloped land in Australia, even in Victoria and New South Wales. The basic answer is lack of soil fertility. We know quite well that most of these undeveloped lands are either under low-carrying natural pastures or else in scrub and forest of little or no value for timber production. We also know that the soils of these areas are deficient in plant nutrients in every instance.

We further know that it is only necessary to define which combination of elements is in deficiency to transform these lands into fertile farms.

In South Australia, scrub lands in the Adelaide Hills were deficient in molybdenum, in phosphorus and quite possibly sulphur. Pastures capable of carrying 3-5 sheep per acre are now established on poor ironstone and podzolic soils. In the south-east of that state the use of superphosphate plus copper and zinc transforms low mallee scrub lands scarcely carrying a wether to 20 acres or more into 2 sheep per acre country. In the Heytesbury district of Victoria there may be a quarter of a million acres of scrub which today is completely unstocked, receiving more than 40 inches of rain per annum, in which a deficiency of phosphorus, calcium and copper has been proved. On the Southern Tablelands of New South Wales poor pasture and scrub country, which barely averages from 1/3 to ½ a sheep per acre, can be developed into 3 sheep per acre country by applying some combination of phosphorus, sulphur, calcium and molybdenum. The same, or very similar results, are being obtained on the Northern Tablelands of New South Wales, in Tasmania and in Western Australia. The evidence we have now considered certainly suggests that my estimate of an additional sheep equivalent per acre is quite modest.

In every instance that we know, the deficiency of a major or trace element is accompanied by the most important deficiency of all, viz., nitrogen. This is the final determinant of how we can develop these lands. More nitrogen is required by all plants than any other element. Consequently, unless nitrogen deficiency is overcome no economic improvement in production will follow the correction of any or all the other nutrient deficiencies. Application of nitrogenous fertilisers is rarely economic and certainly quite impracticable and probably quite uneconomic over the vast terrain which we are considering.

Thus we come to the point—these lands can only be developed through pastures, based on nitrogen-accumulating legumes and the pastures grazed by stock. Subterranean clover, the annual medics,

white clover, lucerne and red clover are the most important plants in the agriculture of southern Australia. If we are to develop the 94 million acres of New South Wales and Victoria no other plants, except perhaps some other pasture legumes, will be of any value whatsoever unless one or more of these species are used to raise the nitrogen and organic matter status of the soils. Attempts to develop these lands through agricultural crops alone are doomed to failure either in the immediate short term or at least in the longer term of a few decades.

Thus to me the rural development of southern Australia falls into a simple pattern. Basically it is necessary to elucidate in detail the deficiencies of major and trace elements in each case; these elements must be applied to the soils; nitrogen and organic matter deficiencies are then corrected by growing pasture legumes, preferably balanced with appropriate associated grasses and finally using the grazing animal to convert such pastures into income.

Following the initial development phase designed to put fertility into the soils, there will follow a second stage in which diverse crops—both for grain and fodder production or other special uses—can be incorporated into a rotation.

In Queensland the developmental phase is not yet solved. You will recognise that in southern Australia the growing of a legume and the correction of nutrient deficiencies other than nitrogen are inseparably linked. In the south, climate affects the detail of which legume and which nutrient may be used but not the major principle involved. We are not yet in a position to say which legumes can be exploited in Queensland because the testing of legumes and the delineation of nutrient deficiencies at the one and same time is now being attempted for the first time. The failure to grow legumes in our tropics and sub-tropics has hitherto been attributed mainly to climatic limitations; soil nutrient deficiencies have been seriously overlooked and their full significance not realised.

Maintenance of a stable agriculture in our cropping areas

There is a grave problem confronting us which is concerned with the existing crop areas of the Commonwealth. Some 29 to 30 million acres of this country are now used for crops. Wheat and oats account for about 2/3 of this area. It is well known that we have no rotation established to overcome and to reverse the soil degradation that follows the repeated fallow-crop rotation so commonly practised. Crawford (1952) has examined the limited statistics available for certain selected wheat-growing districts in New South Wales and Victoria and shows that the major wheat areas preponderatingly use a 1 in 2 or 1 in 3 rotation. The Goulburn Valley or the Midland districts of Victoria have a 1 in 4 rotation. When one realises that oats are a very common feature of 1 in 3 and 1 in 4 rotations the position is extremely grave.

Cornish (1949) showed that, in general, the wheat belt of South Australia was declining in yield except in the higher rainfall and on the more fertile soils of the Lower North. Here the yields were stationary. He further gave a single example from the Lower North of a longer rotation, including a significant pasture and stock phase, in which the yield trend of wheat was upward.

The accumulated work of agronomists and plant breeders over half a century is being nullified because there is no pasture in the rotation to maintain or improve soil fertility. The ultimate consequences of this are:—

(1) Uneconomic crops. (2) Soil degradation and erosion. (3) Eventual elimination of cereal growing from the existing wheat belt.

When this stage of deterioration is reached it will be almost impossible to re-

habilitate these soils with leguminous pastures because the A horizon either will not exist or will be so poor in structure and nutrients that pasture establishment may be so difficult as to be uneconomic. The lower rainfall of the wheat belt places severe limitations on the ease and speed of pasture development which greatly increases the problem of poor soil fertility. In other words it is far easier to improve poor fertility soils if the rainfall is satisfactory.

Permanent cropping in our present cereal belt can only be possible if a much longer rotation—calling for 4 to 8 years of pastures—is developed. This, of course, means that the present cereal belt would scarcely provide our needs for cereals to cover both home and exports.

Where then can we grow the wheat we need? There is only one answer. The wheat must be grown in the higher rainfall areas where fertile soils have been created through the pasture legumes, the correction of soil nutrient deficiencies and the use of the grazing animal.

Far higher yields per acre should be possible from these areas than are possible on the greater part of the present wheat belt because of the higher rainfalls. The plant breeder will be called upon to find or develop new wheat varieties that will fit these climates; that will stand the much heavier or at least different pathogenic attack; that will effectively exploit the higher nitrogen status of the soils after several years of high-producing clover pastures. The argument that wheat growing has been a failure on these very areas in former times is today wholly without substance because this failure was very largely the result of growing the crop on soils much too low in fertility. The initial nitrogen and other nutrient supply was rapidly exhausted by a very short sequence of crops. Nor am I convinced by the argument that the nitrogen content of wheat improves with increasing aridity in the present circumstances. Is this not the result of soil moisture becoming a limiting factor before nitrogen in the drier wheat belt whereas in the moister wheat belt nitrogen becomes limiting before soil moisture?

Farm size

It is perfectly clear that to achieve a longer rotation with pastures incorporated it is necessary to increase the area of a substantial proportion of our wheat farms, because a smaller proportion of arable area will be under wheat at any one time. It must not be assumed that the increase in area has to be equal to the increased area devoted to pastures and sheep. It can be confidently expected that increased wheat yields per acre will compensate, after the initial phase, for the lower acreage of wheat per farm. There is no data available at present which would enable an estimate of the additional area required to be made. The wheat farm would become a sheep and wheat farm and quite a different proportion of income would be derived from each side of the enterprise.

This trend to sheep on wheat farms has been present since the early thirties of this century but the change is far too slow to arrest soil deterioration.

There are two systems of wheat pasture rotations that can be used. (1) Long-term pastures of the order 6-10 years followed by an intensive cropping phase of cereals, preferably without fallows. (2) Shorter-term pastures of three to five years duration alternating with one or two successive cereal crops.

These two systems of cereal/pasture rotation need careful study to determine which will best develop and maintain soil fertility and give the higher return in terms of livestock and cereals. It is probable that important differences will be found as between the main soil groups—mallee, red-brown earths, the grey soils and the black soils—in the kind of rota-

tion to be used, in part depending on the species of legume that is available which, in part, is a function of climate and soil nutrient supply.

In respect to duration of the pasture phase, it is of great importance to note the results obtained by Bath (1949) at Rutherglen where it takes up to three years of vigorous sub-clover pastures to significantly increase soil nitrogen.

In the areas of higher rainfall and poor soils in which pastures can markedly raise soil fertility it is also important to determine what kind of pasture/crop rotation should be practised. Soil fertility might well be very rapidly exhausted under intensive cropping in these areas. It is certain that a high proportion of pasture to cereal phase must be maintained. Fortunately farm areas should be adaquate on these grazing properties, even though the proportion of arable land will be lower than is the case in the mainly flat areas of the present wheat belt.

Mixed farming is essential

Unless we develop more robustly the concept of combining sheep grazing with cereal production over the whole of the present wheat belt and of the inner sheep belt I see no possible way of increasing or even of maintaining our wheat production over a long-term basis. Temporary increases in acreages and of yield per acre may be achieved, but in proportion as we do this by increasing yields and intensity of production, by that much will we reduce the economic life of the wheat areas. Higher yielding varieties from whatever standpoint we achieve them—gross yield, nitrogen content or by more disease resistance—will only tend to accelerate the process. Wheat is an exploitative crop and so is oats. Oats, even when grazed, does not seem to rejuvenate the soil as well as does a poor volunteer pasture. This was at least the interim result recently obtained in a rotation trial now being co-operatively conducted by the Department of Agriculture and the C.S.I.R.O. Division of Plant Industry at the Wongan Hills Experiment Farm in Western Australia.

Until and unless we use pastures to reverse the exploitative process now present in our cereal areas they will be eventually reduced to unproductive lands, but long before this we shall find a process of amalgamation of infertile farms taking place in order to make the enterprise economic. But this stage may well be too late to arrest and counteract the drift in fertility by introducing pastures into the rotation. Thus a scientific and economic technique must be derived to increase the size of wheat farms before this is forced on the farmer by declining production. This, of course, means simply that we must develop far better pastures throughout the wheat belt than we have ever done before.

The crucial importance of the animal in Australian agriculture

The pressure of population on land resources at the level of knowledge then existing in any era seems to result in the elimination of the animal—a change from pastoral to a cropping regime. This is perfectly understandable and a simple result following the fact that more people can be kept alive by growing crops for direct human consumption. They can be kept going for a short term but eventually the scheme collapses because soil fertility is exhausted, famine supervenes and the population reduced to the number that can be maintained at subsistence levels on river alluvials and irrigation areas.

There is always present in Australia an urge to "closer settlement." This is desirable in many ways provided it is based on the concept that every property is designed to carry stock. The trend to wheat farming caused serious trouble after World War I. If "closer settlement" is carried to the point where properties are too small to carry animals

and to grow pastures then this country will, in the long run, perhaps centuries hence, become hopelessly over-populated. The dry land areas will have lost all semblance of soil fertility, the agricultural population confined to coolie standards eking a meagre existence on river alluvials, irrigation areas and the small areas of good soils in our high rainfalls.

It may be that nitrogen fertilisers will be more economically produced than is possible today, but is is doubtful whether our entire power resources could cope with the full demand represented by the capacity of pasture legumes to add nitrogen to the soils. The loss of the pasture and of the animal grazing upon it would mean no steak, no chops, and I doubt whether chicken and synthetic steaks will give us the same health and vigour. The age of synthetics will last as long as coal and petroleum do, or as long as crops can be grown. But then coal and petroleum are finite in quantity and so is the accumulated soil fertility required to grow crops.

Therefore Australia must, in my view, always strive to retain a pastoral agriculture, sheep and cattle, or some comparable animal must always be preferred to cereal and vegetable production, no matter what the apparent waste of calories that is involved.

Again I conclude that pastures are indispensable because stock feeding on crops are always much more costly to maintain because of the heavy labour and mechanical demands for growing, harvesting and feeding the crop and the distribution of the residue and excreta back to the soil.

Conclusions

I reach four conclusions, in each of which I find that pastures are of the greatest importance to this continent.

1. Pastures contribute nearly one-third of the net production in Australia and two-thirds of our primary industry income is derived from pastures.

2. The only way open for the economic development of the agricultural potential of Australia is through the use of legumes in pastures grazed by animals. We appear to have developed about one-fifth of the area of moderate to good rainfall. The forester will contribute an important share, especially in the high rainfall coastal areas.

3. The maintenance of cereal production on 30 million acres now under crop is not possible without rotation with pasture and wheat farms will either fail or become dominantly sheep farms. Cereals must be increasingly grown in the higher rainfall areas where enhanced soil fertility is now practicable through pasture development.

4. Australia must consciously and actively retain a pastoral agriculture. Animals, particularly cattle and sheep, must always remain a dominant feature of our agriculture, and they must be preponderatingly fed on legume-based pastures. Failure to do this will eventually be disastrous, our land will become derelict, our soils eroded, and our rural population reduced to a coolie status. The rise and fall of nations and civilisations seem to be closely associated with the rise and fall of soil fertility.

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ARTICLES

THE BEEF CATTLE INDUSTRY OF AUSTRALIA

By W. A. BEATTIE

THE FOUNDATION OF OUR BEEF CATTLE INDUSTRY

There are striking differences between the initial history of the beef cattle industry in Australia and in the United States of America. There is some evidence that when Columbus arrived in America, European cattle were already there, introduced by Norsemen. This would not be surprising as the Norsemen had long known of the existence of this Continent, having no doubt heard of it from travelling Arctic nomads and having followed up their stories by sailing via Iceland and Greenland. Columbus pioneered the direct route. Those who followed him, to colonise the country in the early 16th Century, definitely brought cattle which spread through the medium of the Spanish Missions but these animals arriving so long before the era of the great breeders were rangy Longhorn types, probably first used mainly for draught purposes and at the same time providing a small milk supply and, when their day was nearly done, being held for beef.

The first cattle brought to Australia were poor draught animals from the Cape of Good Hope and India, but not many of these had arrived before the days of Collings and Bates and the other notable breeders. It can therefore be said that to all intents and purposes, the beef cattle industry in Australia got off to a more auspicious start so far as quality was concerned. From the earliest days we were represented at the sales in Britain of these outstanding cattle, first of all Shorthorns, then Herefords, Devons, Aberdeen Angus and Red Polls. Interest in these sales has never flagged and every year representatives of the best blood in all the breeds mentioned have found their way into the leading studs of the Commonwealth.

For a long time, the Argentine has also been an importer of the best stock from the United Kingdom. There is no doubt however that both the United States and the Argentine have been able to make much better use of this stock, notwithstanding the fact that they still had great herds of primitive Longhorns when we had good Shorthorns. The quality of their output has for many years exceeded that of the Commonwealth. It is clear therefore that something has happened within the confines of those countries which has not happened within ours and which has caused us to be a long way behind them with regard to both quantity and quality of production, despite the fact that there are huge tracts of land here which are only suitable for cattle raising. The greater part of the immense State of Queensland, practically the whole of the Northern Territory, most of the Kimberley district of Western Australia and large areas in the other states are dependent on a beef cattle economy

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but this industry has made next to no progress for nearly three-quarters of a century. What is wrong?

The beef cattle industry in the United States was in the doldrums during the Civil War of the '60s, and the Longhorn herds increased prodigiously. The land in the cattle states became overstocked. The population pressure, however, which Australia is only now really beginning to feel, caused railroads to be pushed out into the remote country. This not only shortened the stock trails (routes) but buyers became active, purchasing stock for slaughter and for growing or fattening according to the needs of those for whom they were buying. The shortening of the stock droves enabled a better class of cattle to be satisfactorily introduced and the Longhorn herds, which had served their purpose well, gave place to British breeds. The further refinement of tropical infusions is now following in suitable areas. Once the buyers could become active the whole modern, complex but extremely efficient, system grew up. Our railways have never been pushed out far enough, hence on the whole we are still where the United States were in the late '60s and early '70s, the main difference being that we have a rangy type of Shorthorn in place of the Longhorn. Our efforts seem to be to perpetuate, by a refusal to recognise the facts, the outmoded system of the past and we continue to kill store cattle in our remote country and at the same time to starve our fattening areas of much-needed stock—nor do we even attempt to draw off such fats as there are and maintain them in good condition to the markets. Population pressure will no doubt compel us to provide those rail facilities which will enable a voluntary but efficient pattern such as that of the United States, to evolve. Lack of realism in this regard is largely if not wholly at the root of our present difficulties.

Our first need in regard to the beef cattle industry—and other industries—is the will to improve, for without it we will not put into effect the findings of research nor will we even follow those few outstanding men amongst us whose properties are cases of production in the desert of the dull unimaginative and orthodox plodding of their neighbours.

ECONOMIC HISTORY OF THE INDUSTRY

To be fair to the cattle man, the economic history of the industry has been very bad. There was a small demand for salt beef to be sent to British outposts such as Mauritius in 1850 but it did not attain a great magnitude. Most cattle were valued only for their hides and tallow. The Franco-Prussian War roused a temporary demand in 1870 but a long depression started in 1873 and lasted till 1897. Recovery till 1912 was very slow. Beef was first sent away in frozen form in 1883 but as consignors had to finance their own shipments till 1899 and risk the market, refrigeration did not at first provide much impetus for the export trade. Serious droughts in 1876-77, 1881-82 and the most disastrous one of 1902 ruined many graziers. There was little to be made out of cattle till the first world war. Just as graziers began to get on their feet, the European financial collapse occurred and the bottom fell out of the market in 1921. However, after a gradual recovery the depression of the thirties followed. Australia has not grown in population like the countries of the American continent, so domestic price has, until the last decade, been based on the export figures.

Tenure in the principal cattle areas has been and still is mainly leasehold. Until 1911 South Australia was in charge of the Northern Territory. In a period of 45 years in which there had been 36 Governments and 43 Ministers trying to handle the situation, a hopeless jumble of experimental land laws piled up, and things have been no better under the Commonwealth control. South Australia was so desperate at one stage that she sent

envoys to Japan to offer the Northern Territory for sale but Japan did not want it. Queensland by 1910 had to bring in an Act to try and get order out of the chaos of 83 existing Land Acts. By 1951 things had again reached a stage of similar complication. Tenants have had to take their leases (28-30 years with, however, resumption rights and other restrictions) more or less on trust, hoping for benevolent treatment by the department responsible for land administration. Western Australia tried a system of short leases but finally gave up in place of much longer ones. Queensland tried State cattle stations and State butcher shops a little over 20 years ago but lost so much money that they had to be abandoned. Up to the commencement of the second world war, when uniform income taxation was administered by the Commonwealth, Queensland had, in addition, the highest income taxation in Australia on incomes over £700 per annum. This State is probably the richest potentially and yet not only has a small population but has made comparatively little progress with its cattle industry. Up till 1946 there was not a single person in any of the Public Services of Australia whose responsibility was the welfare of the beef cattle industry, and even now there is a mere handful and most of them have to combine it with other fields of activity.

THE PROBLEM OF DISEASES

The industry does owe a great deal nevertheless to the veterinary profession. At various times, those dreaded diseases—*rinderpest, foot and mouth* disease and others made a brief appearance but were pounced upon by an extraordinarily vigilant group of men whose successful efforts can never be repaid. We were not so fortunate with *pleuropneumonia* which was allowed to develop largely through uninformed interference. It was later stamped out in Victoria, New South Wales, South Australia and the southern part of Western Australia. It has never entered Tasmania. It could not be eliminated from Queensland, the Northern Territory and the Kimberleys because of lack of cattle control and the consequent impossibility of applying the complement-fixation test. Sporadic outbreaks occur in the south through the agency of 'carriers' but are quickly isolated. The northerners have to add this disease to their other worries.

When the cable was being laid from the East Indies to Darwin in 1872, cattle carrying ticks with the organisms of *tick fever* were imported. As they bred, progeny got loose and met the southern cattle being brought up to populate the Territory. Tick fever broke out and decimated the herds, and the tick with its organisms spread eastwards and westwards and by 1902 had reached the southern border of Queensland. By 1906 it had entered northern New South Wales. Although a comparative immunity later developed in the survivors, tick worry is still one of the most serious problems of those northern cattlemen who live in the more humid areas. The *buffalo fly* was introduced to the Territory in 1838 but its spread was in a series of delayed leaps. It reached the Gulf of Carpentaria in 1908, invaded the northern humid parts of Queensland and the Kimberleys in 1925 and then travelled down towards Brisbane in 1939 and 1941. Buffalo fly worry was very serious and cost the graziers a great deal. In Southern Australia the principal diseases are *tuberculosis* and some *brucellosis*. The extent to which mastitis affects beef cattle is unknown. Periodic plagues of grasshoppers, mice and bush rats are serious and, so far, receive no check excepting, in the case of grasshoppers, in the south, where aerial spraying has been successful.

SUCCESSFUL PLANNING MUST BE BASED ON REALISM AND UNDERSTANDING

It is quite useless making any plans for the development of the industry without taking this background into account. In

as much as their history affects peoples' outlook, that of the industry is just as much a fact as its present state. Many of our modern planners fail just because they ignore the philosophical (particularly the psychological) elements which are just as much facts as soils, plants, animals or any others. In the cattle industry we must have some men who understand its background thoroughly, and who can look at the industry in an overall and yet a sufficiently detailed way, to appreciate which problems of a specialised nature, whether they are economic or biological, need tackling. They must also keep in the most constant and close touch with those men whose research work is devoted to these problems and with the producers themselves. Such economic planning as has seen the light of day in connection with this industry (and there is not much that has) appears particularly unimpressive and lacks realism, seeming to have been based on the often too brief observations of whirlwind official visits.

RECENT ECONOMIC TRENDS

Rise in home consumption

The last decade has seen an important change of atmosphere in certain directions. The large congregation of servicemen from allied countries during the last war brought local demand for beef nearly up to total supply. At one stage, only 4 per cent. of total production was available for export. The immigration programme since, together with natural increase, has led to an unprecedented rise in population and the consequent domestic demand absorbs all but 10 to 12 per cent. of total beef production. It is thus now the local price and not the export price which dominates the market.

Poor returns for northern producers

Until a month or so ago, Britain offered about 67/6 per 100 lb. dressed weight for our first quality export cattle, whereas local prices rarely fell below 100/-. At the low figure which she offered, Britain undoubtedly received our worst meat, that from the remote north for the most part, and even that could have been sold locally to better advantage had the means for getting it to the south been available. Meantime, local prices have risen further (as also have costs) and recently Britain raised her figure to the equivalent of about 97/6. However, this is still a long way below local prices and a great deal below the amount which could be obtained on the free world market. The grazier in the remote parts of Australia was selling meat to Britain at a *net* figure of less than 40 per cent. of that received by the more favoured grazier in the secure areas. The latter's product was going into local consumption. Under the increased price, the return to the less favoured producer will only be increased to about 50-55 per cent. of the latter's return. The representative of the taxpayer (the Commonwealth Government) makes agreements without the prior consent of the graziers in question, and without paying a subsidy to eliminate such anomalies. Thus there is a very strong case for spending money from consolidated revenue in these remote areas, even though it may be in excess of the revenue received therefrom. In the matter of revenue there is this further anomaly—the primary producer resident in the Northern Territory does not pay income taxation, whereas his neighbour in remote Queensland and the Kimberleys does, yet much more money is spent proportionately in the Commonwealth preserve of the Northern Territory than is granted to be spent in these adjoining and often less favoured parts.

A REVIEW OF THE INDUSTRY THROUGHOUT AUSTRALIA

In southern Australia beef production is nearly always complementary to sheep raising and to a lesser extent to cereal growing, market gardening and to fruit growing. It exists alone only in the mountain country where forests and the presence of dingoes and wild dogs render sheep raising impossible. In northern

Australia it exists nearly always alone, on country which is unsuitable for sheep for various reasons.

The Southern States

Beef production in the dairying industry

First of all we will deal with southern Australia—New South Wales, Victoria, Tasmania, South Australia and Western Australia excepting the Kimberley districts. About half the beef supply of these States comes from the dairying industry —culled cows, bulls and unwanted calves. Owing to the fact that the public does not like the meat from young calves, and the surplus of this bobby calf meat over local demand is large, there is an export trade in it, in a boned form. This largely explains the fact that, despite a shortage of beef, most of these States have a small export.

If dairy farmers looked after their stock better, by conserving more fodder and giving more attention to their calves and their pastures, this source of beef would increase considerably. The majority of culled cows and bulls reach the market in poor condition and there is considerable loss, in addition, from bruising, fevered carcases and accidents—broken legs and so on. Dairy stock well looked after make quite good meat provided that they are killed in small local slaughter houses. They imagine that they are going into a bail and if properly handled, as they usually are by the small butchering establishments in the country, they are neither nervous nor fatigued. On the other hand if dairy stock is moved to central markets many difficulties manifest themselves. Unused to walking any great distances, it is pathetic to see a mob of culls struggling along a road in a large mob. Being naturally quiet, they are often belted unmercifully to hurry them along, or to load them into motor or railway trucks or to drive them through the gates of yards and abattoirs. It has been shown by Dr. Callow of Cambridge that a fatigued or nervous animal cannot produce good tender meat. In order therefore to get the best out of beef as a dairy by-product, it is essential for the dairy farmer to see that all his animals are well nourished throughout their lives, and then that culls are handled locally.

So far, in Australia, we have not tackled the question of raising several calves on one milking cow as has been done in the United Kingdom. In the case of a farm, part of which is unsuited to dairying, we might keep some of our cull cows and instead of milking them, put a series of calves, two or more at a time, on them and then wean them on to the otherwise unused part of the property. We would have to provide a supplement for a while unless the pasture was very good. In Britain there is a subsidy of £5 a head on such calves and the ultimate price at which they are sold is nearly twice what we would get here. We cannot therefore slavishly follow this example without going into the economics of it.

On some of our marginal dairy farms bulls of beef breeds are used on the dairy cows and the calves sold either as weaners or later. There is quite a trade of this nature and many of these calves are sold to owners of sheep properties who use them to keep the sheep feed in order.

Beef as a by-product of the dairy industry is very important and no effort should be spared towards still further increasing its output. It involves little more than increasing the efficiency of the dairying industry.

Beef production associated with sheep

There is a great potential source of good quality beef from the sheep properties in the better rainfall areas of southern Australia. Before pasture improvement Merino sheep were run, for the most part, on these properties. Merinos do not need good fences, a decided advantage in country where floods and fires have often destroyed them. However, with the initiation of pasture improvement using superphosphate in the

1920's, and the introduction of improved pasture species including both clovers and grasses, high producing pastures could be grown and maintained. This led in many instances to a change from Merinos to British breeds or crossbreds and better fences were built. Some woolgrowers affirm that cattle are required to control these pastures and such remaining native grasses as the sheep avoid (for example, tussocky species). There are, however, still many properties on which pasture improvement has not been carried very far or on which no cattle at all are carried. As these slowly fall into line there will be a great increase in the number of cattle turned off, and they can be expected to be of the highest quality. Anything that can be done to stimulate this process will do more than anything to increase our beef production.

There are no great problems of transport by rail or road, markets, diseases or the other difficulties as compared with the north. It seems generally agreed by those in the 20 inch and over rainfall areas of southern Australia who carry cattle with their sheep, that cattle are necessary, that their introduction in the right proportion has not lowered the sheep carrying capacity and that they probably have a beneficial effect on the property generally. Research is required into the whole question so that the best advice can be given according to the individual circumstances of graziers. It would be useful to know whether cattle in the right proportion raise the soil fertility with its important secondary effects. In New Zealand it has been said to benefit fleece weight, fleece quality and lambing percentages. We need to know a great deal more about pasture management. For example, should the cattle graze with, in front of or behind the sheep if we are to get the best results on a certain property in a certain season? We need to know whether there is any way of running cattle which will help to break the cycle of internal parasites of sheep; we also need to know whether we are going to reduce the incidence of nutritional diseases of sheep by better grazing control. Where, through topography or similar cause, it is not possible to sow down new pastures, we want to know to what extent we can carry seed and raise fertility by using cattle or sheep or both, whether sheep eat certain plants in native pastures that cattle do not, and *vice versa* (there is much *prima facie* evidence of this). We need to know a great deal about costs. Before the authorities tell people what they ought to do to increase beef production they must prove what can be done and that it is right and economical to do it.

Beef cattle in cereal growing areas

There are very few cattle run on properties devoted to cereal growing, largely because it has not been the custom to use pastures in a rotation. In some areas, lack of adequate drinking water as well as lack of suitable fencing are additional handicaps. There is very strong evidence that in many cereal growing areas, the fall in available soil nitrogen is becoming serious, and in others erosion is a considerable worry. If there should be a pasture rotation, should cattle be utilised? Here again the answer, although most important, is lacking.

The drier areas of southern Australia

In those areas where the average annual rainfall is under 20 inches there is, as a rule, only limited scope for cattle if sheep can be run. On the heavier soils, and there are vast areas of heavy grey and black soils, ground cover consists mainly of those low shrubby plants such as salt bush, the blue bushes, and sago bush. These bushes, mainly edible as drought fodder or as a supplement, usually shelter annual grasses and edible herbs. Unless there are swamps, or unless the country is badly dingo-infested, such as that above the dingo fence in South Australia, there is not much place or reason for cattle. On the lighter soils, and there are considerable areas of red

sandy loams, the ground cover consists in the main of low spreading trees, mainly acacias, with heavy seeding grasses which respond quickly to rain. Many of the trees have edible leaves, flowers and seeds. Sheep can pick up the grass seed, fallen flowers and tree seeds and can make use of short grasses as well. Cattle, on the other hand, can handle the leaves on the lower branches of the trees, and the coarser grasses, but all the same it is hazardous country for them. Below the dingo fence line in South Australia it is mainly sheep land and above it cattle country but some of the sheep men carry a few cattle to graze any swamps and they endeavour to buy store cattle to cope with good seasons when grasses are apt to get rank. There cannot be much increase here and so far as cattle are concerned, it is being used just about as efficiently as can be.

Mountainous country

In the heavily forested and rugged country of the eastern fall of the Great Dividing Range in New South Wales, and in much of the forested country of the Australian Alps, cattle are run exclusively. Land above the winter snow line is leased or agistment given to cattle men in certain areas and cattle are run there in summer.

The greatest prospect for an increased beef cattle turn off in southern Australia lies in running more cattle with sheep in the 20 inch and over rainfall country. There are also good prospects in South Australia where Kangaroo Island and the sandy country of the South East are being rapidly developed and in the developmental areas of Western Australia. Two million acres will be involved in South Australia and considerably more, in the end, in Western Australia.

The beef industry in northern Australia

Now let us return to the north. We can undoubtedly turn off far more cattle than we do, even in the present state of knowledge. There has been a lot of superficial rubbish written about this area and its prospects and it only distracts attention from the real problems.

Stock routes and rail transport

The first problem is transport. Under the post-war direction of Colonel A. L. Rose, Chief Veterinary Officer, who is both a realist and an outstanding organiser, the Northern Territory is now equipped with infinitely better stock routes. There is still much to be done, but the work is proceeding. Many of the Queensland stock routes are bad and in the Kimberleys, they exist mainly on paper. Until the north is opened up by rail transport to the good southern markets (and for many of the cattle, to the recognised fattening areas) it would be folly for the people of the north to try and increase their turnoff. It is only under great difficulty now that the existing turnoff can be handled. Some say that the solution of this is in local killing, but the fact is that treatment charges in the seasonally operating works of the north are so high—and there is no way of reducing them—that there is not enough profit left to the producer to enable him to build up reserves and warrant him developing his property. At a time when the southern producer is receiving £35-£40 for a bullock four years old, the northern man, whose cattle are not sent south and which are mainly 5-6 years old, gets about £12 from Wyndham and £8 (both of which include a direct or indirect subsidy) from the Airbeef works at Glenroy. Wyndham and Glenroy are only essential stop gaps. There is no good reason for believing that they are by any means the permanent solution. The essential need is for rail transport to move the cattle to the source of demand, the fattening areas and the southern markets. When this transport is available, I am inclined to think that the whole pattern will change.

Problems of management

The north is hazardous country in that there is a superabundance of good feed

after the monsoonal rains; the fodder gradually deteriorates in value until some time before the next rains are due, when much is not even of maintenance value. It is extremely doubtful whether, in average seasons, calving percentages exceed 55 per cent. Of the calves born, only about a third ever reach market. We do not know exactly what causes these deaths and we must investigate this thoroughly. We do know that many die because of this deterioration in quality of feed and many because drinking waters are insufficient. Some are killed by dingoes and eagles, some die of tick fever, pleuropneumonia and tick and buffalo fly worry. Some eat poison plants. We think, but we do not know, that deaths occur in a decreasing proportion after cattle survive their first year. If we could take weaners away from their mothers and move them to the best areas of the north, or even to the south, we would undoubtedly greatly increase our turnoff in both quantity and quality without increasing — in fact possibly with some desirable decrease in—total cattle numbers. Numbers on stations mean little. It is turnoff that must be sought and this can best be sought by doing everything possible to eliminate avoidable losses. There is no doubt at all that many deaths occur just because cows with their calves, and cows in advanced pregnancy, are run with the other stock, and, as the feed gets eaten out further and further from the waters only the stronger cattle can walk the necessary distances. The rest get weak from lack of feed and either die of starvation or, in their weakened state, get bogged and die in the waterholes.

Why kill in the north?

My opposition to the killing of cattle in the north is based on the following arguments. First of all, it perpetuates the low monetary return structure, and the north needs a high one. It requires capital for development which is very costly on account of the freight on material and high wages. Adequate financial reserves, to meet the periodic droughts, fires, floods, plagues of pests and other contingencies inseparable from this environment, must also be built up by producers. A low monetary return structure also leads to too little attention being paid to the future and consequently to overstocking and heavy exploitation of the pastures and the soil. Whereas prudent management demands the annual closing of at least a quarter and probably a third of a property to stock, both to allow re-seeding of native grasses and to provide drought reserves, in actual practice this is rarely done. On the contrary, large areas of country have gone completely out of production through wind and water erosion following continued overstocking during the low price periods when it did not pay to move the cattle to the markets. It perpetuates the retention of cattle which should in all probability go elsewhere for growing and fattening and in this way obstructs solution of the problem of increasing turnoff by minimising losses; it perpetuates our bad name in the markets abroad, because it causes us to kill store cattle and also to send away some of our worst cattle which we should consume domestically; it diverts governmental attention and money from our real problems. As an example of the last statement, the accumulated loss to the State of Western Australia on the Wyndham works exceeds a million pounds, whereas in the Kimberleys on the other hand there is not one properly equipped stock route, there has been no research into the real problems of the grazier and there has not been any cattle adviser there at all.

CONCLUSIONS

In concluding this article, it may be apposite to answer the principal questions which are so often asked.

Is the beef cattle industry likely to be able to supply our domestic needs indefinitely? No. Of the present export of at most 12 per cent. of production, half consists of poor quality boneless beef and

the remainder is mainly poor quality beef from northern works. At present, there is no suitable south-bound transport for this beef because of lack of refrigerated space on coastal ships. Population is rapidly increasing but persons engaged in primary production decreasing.

If we become short of beef, whence can we get more? New Zealand is the nearest producer and the only one likely to supply us, but as she relies on the United Kingdom for so much of her secondary needs, she is unlikely to export much to us.

Can we increase our beef production? Yes. It can be increased very considerably but only if we first of all reverse the trend in rural employment, modernise and extend our transport by rail and spend some money on investigating and solving the real problems.

Is not rail transport outdated? The development of the diesel-electric locomotive has revolutionised rail operation. The United States has recently built 33,000 new locomotives and 400,000 freight cars and this in a country where roads are much better than ours and the cost of road transport much lower.

Is not the solution of our northern problems airfreighting and local killing? No. They are temporary stop gaps but so costly that the balance is not sufficient to allow for the necessary profit, accumulation of financial reserves and development of the properties.

Are the problems of the industry very abstruse? The main problems are quite simple and quite orthodox. Their solution should step up production considerably, and in the short term. There are difficult problems associated with long term increases but there will be ample breathing space to solve these if we do first things first. We must however start tackling them right away.

Let there be no doubt at all that the importance of this industry goes further than mere local needs. We have obligations, solemnly undertaken as members of the United Nations Organization, to the undernourished of the world. We have an obligation to the British Commonwealth to use our land, particularly our north, to full advantage, and if we do not we cannot in conscience call on the other members to help us to defend our right to it diplomatically or in war.

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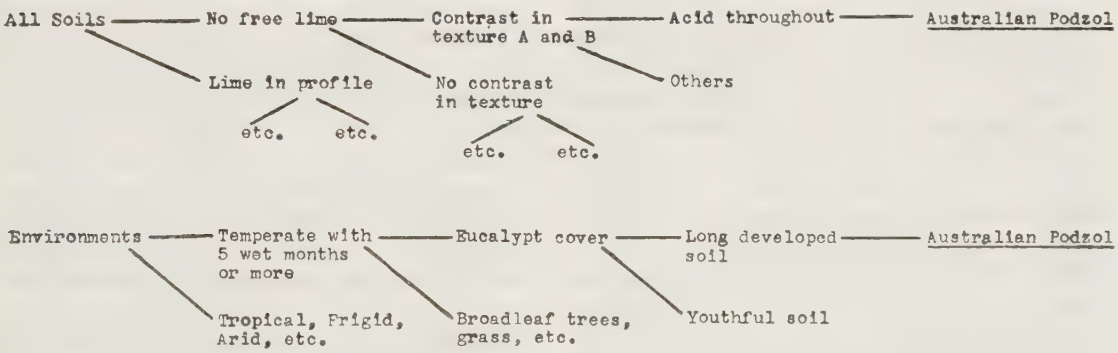
ON CLASSIFYING SOILS

By G. W. LEEPER

Karim's article "A New System of Soil Classification" is the fourth on this topic to appear in this journal within two years (Karim 1952). In commenting on the issues which he raises I feel that soil specialists need not apologize to their fellow agriculturists for taking up space in the journal, since some of the issues are common to other branches of science, and in any case our colleagues must have suffered from the confusion in our subject, and are entitled to an explanation as to how it arose.

We are slowly coming to agree to classify soils-as-they-are, and not to classify them according to guesses about their origin. Slowly, because of the dead hand of the past, because students even now learn the old confusion and have to find their own way out of it later on. If it were not for this dead hand, none of us would hesitate to use the same principles with soil as with anything else.

The following two ways of arriving at our common podzolic soils may illustrate this argument:—



Each of these schemes is consistent within itself. All of us are interested in how a soil might have developed. From time to time, so long as science endures, an enthusiast will suggest a genetical scheme like the second, and new discoveries will be made. But the immediate need is to devise a classification of soils which must be independent of any hypotheses about formation. The hypotheses will change with time, and that is a persuasive reason why they should be kept out of our present subject. This has actually been done by preceding writers in this journal.

We should also agree at the start that man makes classifications for his own convenience. There is no "natural" classification of soil for man to "discover". The belief that there is something to be discovered is a relic of the ancient idealism of Plato, which Robinson has criticized ever so mildly (Robinson 1950). I use the word idealism, not in the foolish popular sense of well-meaning ostrichism, but in the technical sense. It is implied that there "really" is an Ideal Podzol, and that the earthly thing that we see in the field has to be judged by how near it comes to that Ideal. Yet when we ask how this Ideal was revealed, we find that it was invented by an ordin-

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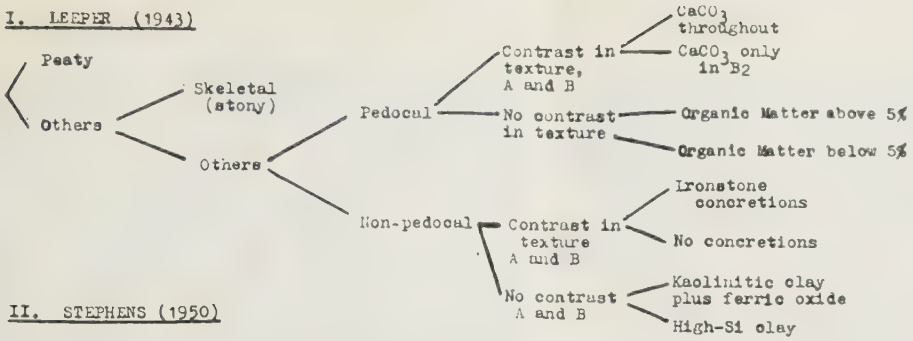
ary mortal like you or me. Let us reject this word-magic. Podzol is just a word which we have invented as a piece of useful shorthand to save us the trouble of writing a long description which comprises a good many profiles that have been studied in various parts of the world. So too, a classification may be sensible or silly; it may be consistent or muddled; but it cannot be "right" or "wrong".

Karim, in disillusion with the schemes of the orthodox books, would like to reject all the old names (Podzol, Rendzina, Terra rossa) and start afresh. I feel in sympathy with him. Perhaps we might re-admit some of the old names to a reformed scheme, but only on the strict condition that they undertake not to give themselves airs. There is no space here, however, for discussing what names we should use; the principles of classifying are enough for one article.

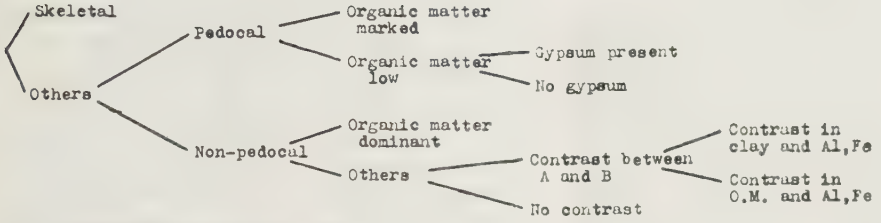
Karim tacitly assumes that we will all agree that the most important property of a soil profile is the one which he selects, namely, the extent to which iron, aluminium and calcium carbonate have been segregated. I do not believe that we have reached this stage of agreement —in fact, this is one reason why the present confusion persists. Consider all the rival properties—segregation of clay, amount of organic matter, dominant clay minerals, proportions of the five major exchangeable cations, structural patterns. It seems to me that we could equally give priority to any one of several properties, and the reason for choosing one rather than another is simply that it will result in a neater scheme. We soon find in practice that we get into difficulties if we subdivide according to property A before subdividing further according to property B; we may find that most of our difficulties disappear if after all we start our subdivision with property C. Several schemes are set out on page 79. These are re-arranged from the authors' original tables in order to show more clearly the basis of each scheme. The only essential change is a little abridgement. The latest form of the orthodox scheme of the United States Department of Agriculture is included at the bottom. It is a queer mixture of hypotheses about origins and description of environment, together with a little reference to the soil's own properties. The authors, it should be noted, are apologetic, and hope "that terms indicating zonality or lack of it may be abandoned eventually in favour of terms based on soil characteristics". The schemes of Stephens (1950) and of Hallsworth and Costin (1950) use the properties of soil without reference to origins, but it is disappointing to note that Karim, in spite of his decision to make a new start, has included guesses of origin in subdividing his classes.

The general resemblance among I, II and III is obvious. The differences are more interesting, and illustrate some of the difficulties to be overcome. Thus in II, the result of making the first major separation into pedocal and non-pedocal is that the fens (in the pedocals) are put far from all the other peats (in the non-pedocals). This is avoided in I and III, where an earlier separation is made into peaty and non-peaty. The major difference between I and III is that III introduces "groundwater present" at an early stage. This weeds out some awkward problems, such as the placing of "meadow soils", but introduces a fresh crop; what happens (a) if a previously dry soil is irrigated, and (b) if a previously wet soil is drained? The authors probably intended to include in this section all soils that show signs of past waterlogging, namely, rusty mottling and ironstone concretions. Yet many of the Australian soils with ironstone concretions have no groundwater today. Finally, I and II, but not III, use the content of organic matter as a distinguishing feature among the pedocals, while I, but not II and III, introduces the dominant kind of clay mineral. We need not pause here to discuss any further the

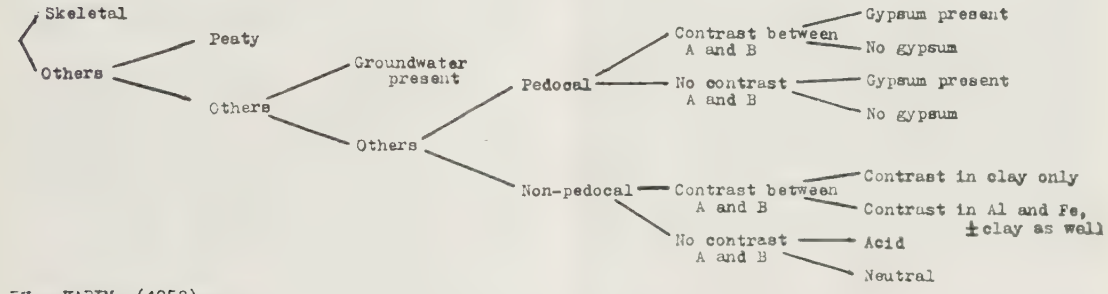
I. LEEPER (1943)



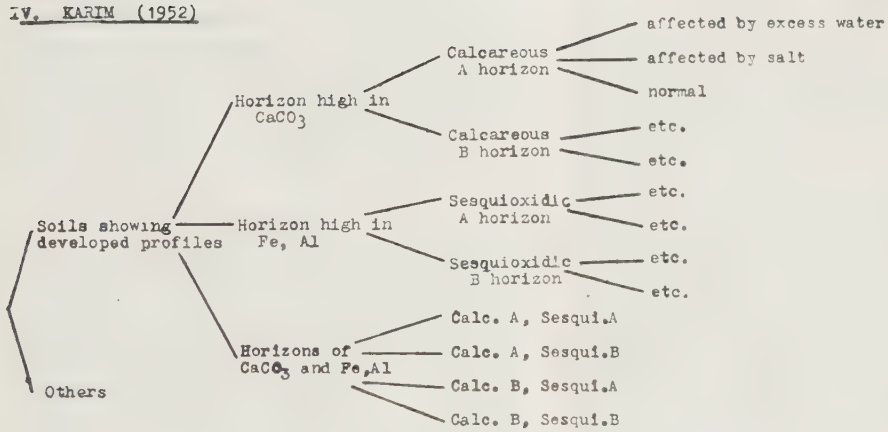
II. STEPHENS (1950)



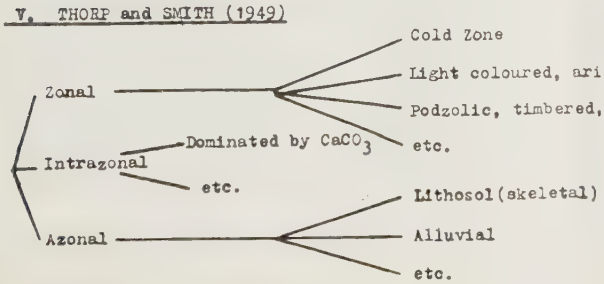
III. HALLSWORTH and COSTIN (1950)



IV. KARIM (1952)



V. THORP and SMITH (1949)



merits of I, II, and III, but should next consider what happens when we come to the end of each branch. We may want to invent names for some of these end-members, and I think we must find more attractive names than Karim has suggested. But we need to subdivide further, to get less and less generalized classes. Can we keep on further with the same process of bifurcation?

I see no reason why we should not continue with the same process; no attempt at doing this has been published in the English language (with the doubtful exception of Sigmond's scheme), but such an attempt is well worth while. There is, however, another possible process, which makes no attempt at completeness but simply lists those combinations of characters that occur most frequently. This could be called a statistical method, and is illustrated here from a hypothetical population in which every member is coded according to the colour of his hair and of his eyes. His hair makes him either A, B, C, or D, and his eyes either E, F, G, or H. By our first, exact method, we have four times four or 16 combinations. But if we count 300 individuals we may find that the following combinations occur: AE, 100 times; AF, 20; AG, 2; BE, 20; BG, 20; CF, 100; CH,2; DH, 34; DF, 2. We may therefore decide to make room only for the six types that are well represented, namely, AE, AF, BE, BG, CF, and DH. The minority types AG, CH, and DF will not be mentioned, except as "aberrant" or "miscellaneous" (and in footnotes). The main virtue of this statistical method is that it saves space; it leaves no empty pigeonholes, such as might occur in any bifurcating method. Its drawback is obvious, namely, that it consigns all but a selected few to a waste-paper basket labelled "miscellaneous". We must make a deliberate choice which of these two methods we will follow. At present, it appears that the transition from our broader divisions to the "Great Soil Groups" is commonly made by the statistical route, though this is seldom openly admitted. But it should be clear that this was the way by which most of the Groups came into being. A particular combination of properties was noted over a wide area. This combination received a name, and was elevated to high rank in the textbooks. One by one other combinations joined the aristocracy, some of them by no better right than the chance that they were noticed by a great man. The next stage was to draw up plausible tables into which the favoured ones might fit, instead of starting from first principles to decide whether they deserved any place at all.

The statistical outlook still appears to prevail in the United States of America. Thus, *Grumusol* has been proposed to cover dark grey clay soils which are to have "all or most" of fifteen listed properties (Oakes and Thorp 1951).

In a circular letter to colleagues six years ago I wrote, "Australian soil scientists have not yet realized that here lies a splendid opportunity for bringing distinction on ourselves. . . . The need is immediate; and we can do the job". That statement still stands.

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CREDIT FOR SOIL CONSERVATION IN AUSTRALIA

By I. MOLNAR

Recently attempts have been made to bolster agricultural production in Australia and various proposals have been put forward including the establishment of new farms. It is not practicable to discuss here the merits and demerits of these various proposals, but whatever course will be taken for the expansion of the agricultural output, basically there are only two alternatives. Either to develop land not used for agricultural production or increase the production on land already used for agriculture. The latter way is likely to be not only cheaper but also quicker. Increased production over any length of time from land already in agricultural use can be achieved only by improved farming methods. This term implies better land use, which in turn means not only soil conservation but also the rehabilitation of already eroded land if it is economically practicable. The adoption of soil conservation practices usually requires some special capital investment, hence farmers will not always be in a position to implement the desirable practices unless credit is made readily available for the purpose. The incentives given to farmers by way of credit for soil conservation in Australia and South Africa, and for land reclamation and improvement in Great Britain are discussed below.

The problems associated with Rural Credit in Australia were discussed in great detail in the Fifth Report of the Rural Reconstruction Commission (1945). With reference to government participation in the provision of rural credit, this report, although condemning the lack of co-ordination of existing governmental credit schemes and the creation of a new and separate fund for each activity, also points out that "It would be unsound to rely entirely on private enterprise being able and willing to meet the credit requirements of agriculture. Participation by governments is therefore essential".

At the beginning of 1952, the soil conservation services in the various states and also the Commonwealth Bank of Australia, State Savings Bank and Rural Finance Corporation of Victoria, the State Bank of South Australia, Rural Bank of New South Wales, and the Agricultural Banks of Tasmania and Queensland were asked whether they provided loans for soil conservation purposes and what conditions are set by them for the provision of such loans.

This inquiry revealed that:—

(1) Queensland is the only State where no state governmental or semi-governmental organization exists with authority for the provision of loans for soil conservation.

(2) The soil conservation services of Victoria, Western Australia and Commonwealth Territories, although authorized to provide credit, so far have not issued any, nor have conditions been laid down for such issue of credit.

(3) The Commonwealth Bank of Australia, the State Savings Bank and Rural Finance Corporation of Victoria and the Agricultural Bank of Tasmania have the authority for the provision of loans for soil conservation and they *may* have provided credit for this purpose. The Com-

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monwealth Bank and the State Savings Bank of Victoria do not differentiate between the purpose of rural loans and treat all of them uniformly. The Rural Finance Corporation of Victoria and the Agricultural Bank of Tasmania differentiate between the purpose for which loans are made.

(4) The Soil Conservation Branch in South Australia determines the conditions of loans specifically for *each* loan, while the State Bank of this State does not provide loans for soil conservation.

(5) The Soil Conservation Service in New South Wales (in conjunction with the Rural Bank of New South Wales) is the only organization in Australia which has not only specified the conditions of loan for soil conservation purposes in general, but which has also prescribed the conditions to which an applicant has to conform for his application to be considered and for the payment of advances.

Certain features of the credit scheme in New South Wales have some resemblance to the one implemented by the Soil Conservation Board in the Union of South Africa and for land reclamation and improvement by the Lands Improvement Company and the Agricultural Mortgage Corporation of Great Britain. It is therefore desirable to describe briefly the way in which credit is provided by these four different institutions.

Soil Conservation Service in New South Wales in conjunction with the Rural Bank of New South Wales

When an application is received, it is referred to the District Soil Conservationist in the area where the applicant's holding is located for inspection and report on the work considered necessary. (The work recommended by the Service need not be, and as a rule is not, identical with the work proposed in the first instance by the applicant.) At this juncture the applicant is requested to complete a statutory form of application that he is agreeable to carry out the work recommended by the Service. If he is unwilling to undertake all the work considered necessary by the Service, partial operations will not be approved unless the Service is satisfied that they will be effective as part of an over-all plan that could be completed at a future time (private communication, Soil Conservation Service of N.S.W.).

The Soil Conservation (Amendment) Act 1947, and regulations stipulate other aspects of the administration of credit. After the receipt of the statutory form of application the Service provides the landowner with a statement which sets out the type of works approved and their estimated cost, the conditions of land-use which the owner must observe during the currency of the advance and the amount of advance tentatively approved. If in the statutory form of application the landowner expressed his desire to have the works done by the Service, and the Service is willing to do so, then this statement will stipulate also the conditions under which the works will be performed, and the amount which has to be paid by the landowner before the commencement of works. This amount must not exceed, however, ten per cent. of the estimated cost.

After the Service has completed the works it issues a certificate to the Bank. The Bank then pays the Service for the completed works. If, however, the landholder or some other person or body other than the Service, has completed the works then the Bank pays the amount of advance to the owner, provided the Service certified that the works have been carried out or are being carried out in a satisfactory manner in accordance with the prescribed stipulations. When the works, in respect of which advance is made, are not carried out by the Service, but the Service hires to the owner machinery and equipment for their construction, the amount payable for the hire is regarded as part of the advance.

The advance is secured by a statutory charge over the land of the owner which

takes priority over any other mortgages whether already registered or not. A deed of charge must be executed by the owner before the commencement of works by the Service or before an advance is made by the Bank.

If the owner of the land fails to comply with the conditions of the advance or fails to maintain the works constructed, then at the option of the Bank, the whole of the advance, together with interest, becomes repayable immediately.

Four loans amounting to £A 971 were outstanding at December 31, 1951 (private communication, Rural Bank of New South Wales).

Soil Conservation Board of the Union of South Africa

The regulations, amended in 1949, under the Soil Conservation Act 1946, deal with the administration and conditions of credit. The Soil Conservation District Committee (if any) or an officer designated by the Minister of Agriculture must certify the estimated cost of the proposed soil conservation works and measures before a soil conservation loan or subsidy is approved. In case of grants, the Committee or the officer has to certify any temporary loss of production suffered by the landholder, and also recommend an amount for grant.

Loans

The owner of any land whose application (on a statutory form) for a loan has been accepted by the Minister of Agriculture may be paid advances on the loan. The sum of all the advances, at any particular date, must not exceed the estimated cost of the works or measures approved by the Board. Also, advances are made on works and measures (constructed or applied by the owner) which have been completed, or are in the course of construction, or on any material, implements, draught animals, trek gear, machinery, seeds which are to be acquired for such works or measures. All loans so far issued are secured by a charge noted against the title deed, but the Minister accepts other types of security. (Private communication, Soil Conservation Board, Union of South Africa.)

On the date on which a soil conservation loan first begins to bear interest an amount of rebate, calculated on a basis determined by the Minister of Agriculture in consultation with the Treasury, may be deducted from the total amount of the loan. Henceforth interest and instalments become payable only on the reduced balance.

Subsidies and grants

In respect of portions of completed and approved soil conservation works and measures applied by the owner or occupier of the land at his own expense a subsidy may be paid. Subject to certain specifications and conditions the amount of subsidy or rebate is 25 per cent. of the cost of construction of silos and 50 per cent. of the cost of construction of earth works, masonry and concrete, weirs, fencing, reclamation of salt-affected irrigated land, wells or drains (private communication, Soil Conservation Board, Union of South Africa).

Grants can be made when there is any temporary loss of production as a result of certain measures which are part of an approved soil conservation scheme. A grant can be made when any of the following measures have either been implemented or are in the course of implementation:—

(a) the preparation of land in any special manner for the sowing or planting of crops; or
(b) the rotation of crops or strip cropping; or
(c) the temporary withdrawal from cultivation or grazing of any defined portion of the land for specified periods; or
(d) the restriction of the number and kinds of livestock which may be grazed for any specified periods on any defined portion of land; or

(e) the treatment and management of of forests and plantations, including the disposal of slash, debris or waste.

So far, no payment of grants has been made (private communication, Soil Conservation Board of South Africa).

Provisions against Default

On default of any of the conditions of the loan the landholder is given the opportunity to make good within a stipulated period (not less than 30 days). If he does not take advantage of this opportunity then the loan with all interest already accrued becomes repayable immediately. On default, the rebate on a loan is cancelled and remains due and payable as part of the loan, while the Secretary of Agriculture can recover in court the amount given as a subsidy with 4 per cent. interest calculated from the date of payment.

Ross (1950) showed that during the year ended June 30, 1950, £S.Afr. 128,305 was paid out for subsidies and £S.Afr. 16,000 for loans.

The Lands Improvement Company* and the Agricultural Mortgage Corporation Ltd.† of Great Britain

Both of these organisations are authorized to provide loans under the Improvement of Land Acts 1864 and 1899 for specific purposes. Leaflets issued by these organizations (1950-1951) show that these organizations provide loans for cottages, farm houses, farm buildings, drainage, water supply, fencing, farm roads and bridges, irrigation and reclamation, electricity, afforestation, silos, and other improvements. The Agricultural Mortgage Corporation is authorized also to provide loans, under the Agricultural Credits Act 1928, without restriction on the use to which a borrower may apply the money. Loans provided by either of these organizations, under the Improvement of Land Acts, have to be sanctioned by the Ministry of Agriculture and Fisheries. Loans provided by the Agricultural Mortgage Corporation, under the Agricultural Credits Act for any unspecified purpose do not need the Ministry's sanction.

A loan sanctioned by the Ministry becomes an absolute charge on the holding and it has priority over every existing and future charge; hence loans can be made available for improvement up to the full cost of the works regardless how heavily mortgaged a property may already be. Loans provided without the sanction of the Ministry are, however, limited to two-thirds of the valuation of the holding and have to be secured by first mortgage.

After the provisional approval of the loan by the Ministry, the landowner enters into contract with either of these two organizations. The Ministry then issues under Seal a Provisional Order approving the expenditure. This Order constitutes an authority to proceed with the improvement, the plans and specifications of which had to be approved by the Ministry. The improvement will have to be executed under the supervision and control of the landowner or his agent. On completion of the works to the satisfaction of the Ministry, money is advanced by the organization which then takes an Absolute Order of the Ministry by which a Rent Charge is created on the land improved.

The Lands Improvement Company also plays a part in the administration of subsidies and grants. It was mentioned before that loans can be provided, with the Ministry's sanction, among other things, for cottages, houses, drainage and water supply. For these purposes, in addition

*At December 31, 1951, the authorized share capital of the Lands Improvement Company was £stg. 2,500,000, of which only £stg. 100,000 had been taken up in 20,000 shares of £stg. 5 each. The Company also borrows money from the insurance companies (its main shareholders). At December 31, 1951, the total amount of advances received by the Company from the insurance companies was £stg. 634,494. The Company is not subsidised from public funds and the Ministry has no control over it.

†At March 31, 1951, the Agricultural Mortgage Corporation had an authorized share capital of £stg. 750,000 (all issued in shares of £stg. 1 each), loan capital (secured by debenture stock) of £stg. 18,114,279 and loans from the Ministry of Agriculture and Fisheries of £stg. 900,000. The shareholders of the Corporation are the main joint stock banks.

to loans, landowners can obtain, in approved cases, subsidies and grants, provided the authority paying the grants approves the proposed improvements before work starts. For each new cottage erected for rural workers, a subsidy of £stg. 15 per year over a period of 40 years can be obtained. Grants become available up to 50 per cent. of the cost of improvements made to farm houses costing between £stg. 110 and £stg. 600, up to 50 per cent. of the cost of drainage schemes, 25 per cent. of the cost of water supply from public source of water, 40 per cent. of the cost of water supply from private source of water, and also for "hill farming schemes".

The balance sheets (1951) of these institutions show that on loans issued with the Ministry's approval the Lands Improvement Company had £stg. 1,083,516 outstanding at December 31, 1951, and the Agricultural Mortgage Corporation had £stg. 86,900 outstanding at March 31, 1951. On loans issued on first mortgage this Corporation had also £stg. 16,893,631 outstanding at March 31, 1951.

DISCUSSION

Priority ranking of security requirements

There is an almost complete lack of uniformity in the conditions set by the five Australian governmental and semi-governmental organizations which have the authority to provide loans for soil conservation purposes. One of the outstanding differences is the security requirement. First-class credit is available to a landholder for soil conservation purposes in:—

(1) New South Wales, regardless of how heavily the security may already be mortgaged (Soil Conservation Service of New South Wales in conjunction with the Rural Bank of New South Wales);

(2) Victoria and Tasmania, only if the existing mortgage still leaves sufficient security (Rural Finance Corporation of Victoria and Agricultural Bank of Tasmania);

(3) Other States, only if security is free from mortgage. It is reasonable to assume that the major commercial credit institutions do not provide rural credit unless the priority ranking offered is as good as that required by the Commonwealth Bank, namely, first mortgage or charge. Thus outside New South Wales, Victoria and Tasmania, landholders with their holdings already mortgaged will be generally forced to obtain a second-class type of credit for soil conservation purposes unless the mortgagees consent to an increased loan.

The credit provided by the Soil Conservation Service of New South Wales (in conjunction with the Rural Bank of New South Wales), and the credit provided under the Improvement of Land Acts in Britain, becomes a statutory charge which takes priority over all mortgages whether already registered or not. In Australia such an absolute priority has its disadvantages, although it is fully justified because soil conservation on a mortgaged holding is in the interest of all mortgagees concerned. This disadvantage is relatively small if the credit for soil conservation is provided by an organization which carries out a general banking business (e.g., Rural Bank of New South Wales), because the landholder can obtain first-class credit for other purposes but he is confined to the one source. If, however, the absolute priority of charge is registered by an organization which is not providing general banking service then it is likely that the majority of landholders would be discouraged from seeking credit from such a source, no matter how generous the terms may be. A landholder accepting credit under these circumstances would lose the credit facilities of those institutions which stipulate first mortgage as priority ranking. He would be forced to obtain credit from sources prepared to accept security of second-class standing for all purposes other than soil conservation. In England and Wales, where two-thirds of the

agricultural holdings are occupied by tenants, the business of the vast majority of farm operators is not affected by an absolute charge on the holding.

Some other conditions of credit prescribed by five Australian governmental and semi-governmental organizations, the Soil Conservation Board of the Union of South Africa and two British rural credit institutions are set out in Table I and will be discussed in their turn.

Limits to Credit

In determining the conditions of a loan these five Australian organizations, with the exception of the Soil Conservation Service in New South Wales and the Agricultural Bank of Tasmania, do not take into account the cost of the works involved. Further, there is no evidence that any of these organizations take into consideration the expected increase in farm returns due to soil conservation measures and the resultant increase in the value of the land. Unfortunately, little or no Australian data is available to guide on this point, and Ashby (1949) showed that the position was not much better in Great Britain with respect to land reclamation and improvement. However, in Great Britain and in the Union of South Africa these criteria are taken into account when determining the amount of a loan.

Period Available for Repayment

Only in Great Britain is the life of the improvement considered when the period for repayment of the loan (issued with the Ministry's approval) is determined. The period is so determined that repayments are completed before the value of the improvements is exhausted. In the Union of South Africa the period available for repayment can be in excess of 26 years, while in New South Wales 15 years is set as the maximum period. Although the British practice appears to be the logical one it is somewhat difficult to apply it to soil conservation works. In Australia the lifetime of the various soil conservation works is not yet known. Furthermore, the change in land use, which it is desirable to introduce with these works, will often provide adequate protection before the effective life of the works has expired. The period set for repayment of the loan is, therefore, likely to be either too long or too short. If, on the one hand, the period is allowed to be relatively long and the credit institution has not got the power to stipulate or at least to supervise the land use on the holding, then repayments may have to be made for many years when benefit is no longer derived from the works. If, on the other hand, the period is relatively short, repayments have to be completed before any extra return is derived from the works. The solution seems to be, until more information regarding the life of conservation works becomes available, to provide credit on long terms subject to a land-use approved and supervised by the credit institution during the currency of the loan. In New South Wales this practice is followed, and the maximum period permitted in the Act has been allowed for repayment on all applications so far approved (private communication, Soil Conservation Service of New South Wales).

Rates of Interest

The rates of interest charged on loans by the different organizations set out in Table I show a relatively small variation. Among the five Australian organizations the Soil Conservation Service of New South Wales charges the lowest interest (3 per cent.) and the Agricultural Bank of Tasmania the highest one ($4\frac{1}{2}$ per cent.). The former organization has the loan secured by an absolute charge on the land, while the latter organization by a mortgage but not necessarily a first mortgage.

Since soil conservation is virtually part of a land development or a land improvement scheme, there is an analogy between soil conservation and War Service

TABLE I

Showing some conditions of credit provided by Australian governmental and semi-governmental organizations with authority to issue loans for soil conservation, with corresponding conditions of the Soil-Conservation Board of the Union of South Africa and two British rural credit institutions, at January, 1952.*

NAME OF ORGANIZATION	LIMITS TO CREDIT IN TERMS OF:—		MAXIMUM PERIOD ALLOWED FOR THE REPAYMENT OF LOAN	PER CENT OF INTEREST CHARGED PER YEAR
	VALUATION	MAXIMUM AMOUNT		
Soil Conservation Service of N.S.W. in conjunction with the Rural Bank of N.S.W.	Full cost of works approved by the Minister for Conservation		15 years	3%
Commonwealth Bank of Australia	70% of valuation of holding	£10,000	41 years (on Credit Foncier terms)	4% up to 20 years, 4⅛% between 21 and 41 years†
	Not disclosed	No maximum fixed	Generally not exceeding 20 years (on overdraft terms)	4¼%
State Savings Bank of Victoria	Two-thirds of valuation of holding	£2,000	Balance becomes due at the end of the tenth year‡ (on Credit Foncier terms§)	4⅛%†
Rural Finance Corporation of Victoria	99% of valuation of holding	£10,000, or with the Treasury's consent higher amount	No limit, but longest period so far approved 20 years	Varies between 3½% and 4½% according to the purpose of loan. Generally 4%
Agricultural Bank of Tasmania	Full cost of works, provided adequate security available		Generally within 10 years	4½%**
Soil Conservation Board of the Union of South Africa	Estimated cost of works and/or materials and equipment required	Aggregate value of securities	20 years from date on which loan began to bear interest	4%, but no interest is charged for 6 years from date of first advance, or 3 years from date of last advance, whichever is the earlier.
Land Improvement Company of Great Britain	Full cost of works approved by the Minister for Agriculture and Fisheries		40 years	4¾%†
Agricultural Mortgage Corporation Ltd. of Great Britain				4¾%†
Agricultural Mortgage Corporation Ltd. of Great Britain	Two-third of valuation of holding	No maximum fixed	60 years	4¾%†§§

* Since the Soil Conservation Branch in South Australia determines the conditions of credit specifically for each case, it is not practicable to include this organization in the Table.
† Interest cannot be increased during the term of the loans.
‡ Renewal may be granted at the end of this period.
§ May be determined on the basis of a period in excess of 10 years.
**Sometimes interest only is payable in the initial period.
§§Raised on February 26, 1952, to 5½% to enable the Corporation to make a public issue of debenture stock for provision of funds for lending.

Land Settlement. When making such an analogy it has to be borne in mind that War Service Land Settlement, apart from the aspect of national gratitude to former members of the Forces, is aimed at the agricultural *development* of certain areas, while soil conservation aims at the *prevention of soil loss and the development* of agricultural areas. Furthermore, while the cost of development of a holding under the War Service Land Settlement scheme is measured by thousands of pounds, the capital outlay for soil conservation works on a holding is generally measured by hundreds of pounds. It is, therefore, interesting to compare the rates of interest charged for soil conservation with rates of interest charged under the joint Commonwealth-State legislation for post-war War Service Land Settlement.

Molnar (1950) has given details of the agricultural and financial aspects of the joint Commonwealth-State War Service legislation. The rates of interest charged on advances made for improvements under this scheme can be summarized in a generalized form as follows:—

State	Developmental Improvements	Additional Improvements
N.S.W.	2½%, but during the first five years interest only is payable.	In areas outside the Western Division and Irrigation Areas: 3¾%, but during the first five years interest only is payable. In Western Division: 3½%
Victoria	2%	Under temporary and interim leases: 3% Under purchase lease: 3½%
Queensland ..	Not more than 4%, but for at least five years interest only may be payable.	
S.A., W.A., Tas.	3¾%	

Thus finance is provided for improvements under the War Service Land Settlement scheme in every State at rates of interest considerably more favourable than the rates of interest charged on soil conservation loans.

Other Charges

On loans which are provided by the Soil Conservation Service of New South Wales, on overdraft terms by the Commonwealth Bank, and on loans issued by the Soil Conservation Board of South Africa no charge other than interest is made. On loans issued on Credit Foncier terms by the Commonwealth Bank and State Savings Bank of Victoria, and on loans provided by the Rural Finance Corporation of Victoria, the Agricultural Bank of Tasmania, the Lands Improvement Company and the Agricultural Mortgage Corporation of Great Britain certain extra charges are also made for valuation. In addition, incidental expenses of the credit institution are usually charged to the borrower which may amount to a sum which is quite a considerable portion of a relatively small loan.

Conditions for Repayment

On loans issued by the Soil Conservation Service of New South Wales, on Credit Foncier terms by the Commonwealth Bank and State Savings Bank of Victoria, and on loans provided by the Agricultural Mortgage Corporation and the Soil Conservation Board of the Union of South Africa, equal half-yearly repayments are required. Loans provided by the Lands Improvement Company are repayable either by half-yearly or yearly instalments. Loans issued by any of these organizations, as well as those issued by the Agricultural Bank of Tasmania can be "called in" only upon default. The Agricultural Bank of Tasmania and the Rural Finance Corporation of Victoria determine the condition for repayment separately for each loan. Loans provided by the latter organization generally cannot be "called in", while those provided on overdraft terms by the Commonwealth Bank can be "called in" at any time.

CONCLUSION

The credit facilities for soil conservation in Australia compare unfavourably

with those in the Union of South Africa, and with the rural credit facilities in Great Britain. In Australia, only in New South Wales is systematic governmental credit available for soil conservation. This means that in this country there is not only inadequate financial encouragement given for the implementation of soil conservation works and measures, but also lack of adequate credit for those landholders who are likely to need it most, namely, landholders with eroded land or in areas of erosion hazard. Since eroded or erodable land decreases the value of any holding, landholders with such land are likely to find it difficult to obtain credit for soil conservation because loans are limited by the valuation put on the holding by the credit institution.

It would be desirable to make credit available in Australia for soil conservation purposes through the existing governmental and semi-governmental credit institutions. Two (not mutually exclusive) alternatives could be considered:

The first alternative is that these institutions dispense with first mortgage as a priority requirement and before the issue of a loan for soil conservation purposes they consult the soil conservation services in the respective states. The services could advise them not only on certain aspects of the desirable terms, but could also stipulate the necessary works and measures, and supervise the land-use during the currency of the loan. In Tasmania there is already a close cooperation between the Agricultural Bank of Tasmania and the State Department of Agriculture. Applications for rural loans are forwarded by the Bank to the Department whose officers make valuations and submit reports and recommendations considered necessary.

The second alternative is that a loan issued to a landholder by the soil conservation service, secured by an absolute charge on the holding, should not debar such a landholder from further credit, for purposes other than soil conservation, even if normally these institutions do not accept priority ranking other than first mortgage; provided there is no charge on the holding other than the one registered by the soil conservation service and there is still adequate security available.

These institutions cannot be expected, however, to provide loans at a reduced rate of interest for soil conservation unless funds are provided by both Commonwealth and State governments specially for this purpose. If such funds were made available then loans could be provided over a period which suits the financial position of the borrower and at a rate of interest which is not out of proportion with the expected financial return as a result of soil conservation works and measures.

Soil conservation, quite apart from the recent food production drive, is of national importance. Soil conservation works, in general, require a relatively small capital outlay and through them, better farming practices are fairly easily introduced into the farms. For these reasons, would it not be justifiable to charge rates of interest which are in line with those charged on advances under the joint Commonwealth-State War Service Land Settlement legislation?

Whatever conditions are laid down for a soil conservation loan, they can be effective only if the works and measures are correctly applied and are accompanied by appropriate land use. In this regard the experience with soil conservation loans in the Union of South Africa should serve as a warning. The Director of the Soil Conservation and Extension of the Union, in its annual report (1950), mentions that "Farmers are still inclined to devote their full attention to subsidised works, and to neglect the closely associated indispensable soil and water conservation measures, with the result that many of the mechanical works are mere

white elephants—the symbols of wasted money and labour".

Although in recent years there has not been a big demand in Australia for loans for soil conservation purposes, this has been largely due to prosperous conditions. If there is a real determination to increase the agricultural output of this country then adequate soil conservation measures are likely to provide a more permanent increase in production than any other single device. Adequate credit facilities for these purposes could, therefore, indirectly stimulate agricultural production.

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TECHNICAL PAPERS

WEBWORM DAMAGE TO PASTURES IN THE SOUTH-WEST OF WESTERN AUSTRALIA

By M. M. H. WALLACE and J. A. MAHON

Summary

The nature and extent of damage to sown subterranean clover pastures by webworm larvae (probably *Talis pedionoma* (Meyr.)) are described. Heavy infestations may reduce the yield of grasses by as much as 88 per cent. and the total production of the pasture by 50 per cent. The resultant changes in the composition of the pasture are discussed.

DDT dust incorporated in superphosphate at very low concentrations and applied during the late summer months achieved excellent control of this pest. Control for two seasons was obtained with heavier dressings.

Introduction

During the years 1949 and 1950 pastures in the Katanning district in the south-west of Western Australia were severely attacked by larvae tentatively associated with adult moths which have been identified as *Talis pedionoma* (Meyr.) — family *Crambidae*. Recent observations have suggested that more than one species may be present in these infested areas and damage cannot, therefore, be attributed definitely to any one species. Newman (1932) described attacks on wheat crops by webworms which were then identified as *Sclerobia tritialis*. It is apparent that a further study of the group must be undertaken before the status of the various species can be established. It would appear that the general habits of the species involved in the outbreaks are similar, and for the purpose of this paper it will be assumed that the major species responsible was *T. pedionoma*. In many areas wheat crops also suffered injury and in cases of heavy infestation, re-sowing of the crop was often necessary.

During 1947 and 1948 webworms were not numerous and there was no suggestion of the impending 1949 outbreak, when the population reached a very high level. The numbers declined in 1950 and although damage was considerable, it was not as severe as in 1949. Large numbers of *T. pedionoma* moths were present in the autumn of 1951, but the larval infestation which followed was on a comparatively minor scale. There appears to be no necessary correlation between the number of moths on the wing in the autumn and the extent of the larval damage during the following winter.

Life-history and habits of T. pedionoma

In the southern wool-growing areas of Western Australia *T. pedionoma* adults usually appear about the first week in April, reaching a maximum density a week or so later. The moths remain plentiful for about three weeks, after which the numbers begin to decline and few are to be seen by the first or second week in May.

The moths normally remain quiet during the day amongst the dry ground herbage and fly only when disturbed. At night, they are strongly attracted to light and when numerous may become a nuisance in houses.

Although oviposition has not been observed, it is thought that the adult females lay their eggs amongst the dry grass near

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the ground. The young larvae, after hatching, usually burrow a short distance into the ground and construct a small, more or less vertical, silk-lined tunnel with the entrance at the soil surface. Occasionally tunnels are constructed amongst the debris above ground level. The larva emerges to cut off a blade of grass which is drawn into the entrance of the tunnel and devoured. As the larva feeds, the grass blade is drawn further into the tunnel until it is all consumed. Should the leaf become too dry, it is left in the entrance of the tunnel and fresh food is sought.

The fully-grown larva is about $\frac{3}{4}$ inch in length and varying in colour from light to dark brown with a darker head. Feeding is usually completed by the middle of August although occasionally larvae have been found in the pastures as late as October.

Field observations show that webworms feed exclusively on *Gramineae*, including silver grass (*Vulpia* spp.), barley grass (*Hordeum* spp.) and brome grass (*Bromus* spp.). They will also attack wheat but do not appear to feed on oats. Rye grasses (*Lolium* spp.) also appear to be relatively resistant.

Experimental methods

In 1949 a series of experimental plots was laid down with the primary object of determining the effects of DDT treatment on the Red-legged Earth Mite (*Halotydeus destructor* (Tuck)) which feeds principally on subterranean clover and capeweed. However, only a minor infestation of this pest developed and the damage caused was negligible. Instead, a severe infestation of webworm appeared and it was decided to take the opportunity of observing the effect of this pest on the growth and composition of the pasture.

The plots used were each seven links square and protected by a six-inch strip of galvanised iron embedded two inches

TABLE I

The effect of DDT on the mean total yield of the pasture and its components cwt./ac. dry weight.

Treatment (1949 only).	October 23, 1949.					October 16, 1950.				
	Sub-clover	Volunteer* Grasses	Capeweed	Misc.† spp.	Total	Sub-clover	Volunteer* Grasses	Capeweed	Misc.† spp.	Total
Control—90 lb. superphosphate only.	9.71	5.20	5.74	1.88	22.53	19.12	12.79	13.85	5.00	50.76
90 lb. superphosphate, including 0.25% DDT.	5.99	34.44	3.24	0.03	43.70	25.57	4.08	6.96	5.18	41.79
90 lb. superphosphate, including 0.5% DDT.	6.81	35.47	3.17	2.30	47.75	25.00	11.17	4.22	4.04	44.43
90 lb. superphosphate, including 1% DDT.	6.22	34.87	3.49	4.82	49.40	20.48	22.32	2.26	4.90	49.96

* Volunteer grasses included: *Vulpia* spp., *Hordeum* spp., and *Bromus* spp.

† Mainly *Erodium botrys* and Rye grass (*Lolium* spp.).

Sig. Diff. ($P < 0.05$)	1949	1950
Subterranean clover	2.86	4.92
Volunteer grasses	5.76	6.00
Capewed	3.05	4.80
Total yield	4.54	6.62

in the ground. These barriers were treated periodically with creosote to prevent pest migration into or out of the plots. The experimental area was protected by a boundary fence and was not grazed by stock at any time. Superphosphate with DDT incorporated at four concentrations, viz., nil, 0.25 per cent., 0.5 per cent. and 1 per cent. was applied at the rate of 90 lb. per acre as a single dressing. These DDT treatments were applied on March 25, April 14 and May 6, using separate plots on each occasion. The twelve treatments were randomized within each of five blocks. Thus the design of the experiment was:—

DDT concentrations	×	Times of application	×	Replications
4 levels		3 occasions		5

No further DDT was applied in the second year but all plots were top-dressed with superphosphate at the rate of 90 lb. per acre in April, 1950.

Foliage samples were cut from all plots at the end of the 1949 season (October 23) and again at the end of the 1950 season (October 16). On both occasions an area of 12½ square links was harvested from each plot. After drying, the samples were sorted by hand into their main botanical components and the yields of each determined.

Results†

(a) *1949 Yields*

Applications of DDT at the three concentrations employed gave virtually a complete kill of webworms. Increased production of grasses and some other minor species with reduced yields of subterranean clover resulted. This latter effect can almost certainly be attributed to the more intense competition—principally for light—offered by the tall-growing grass species. In the DDT-treated plots there was some reduction in the yields of capeweed. In no case was the difference from control significant but the effect was consistent and was probably due to competition with the grasses, although there may also have been some phytocidal effect of DDT on capeweed growth. Similar but less marked reductions in capeweed yield have been noted in other experiments after applications of DDT.

The most outstanding result in 1949 was the marked effect of webworm attack on grasses and indirectly upon other pasture species. A comparison of the yields from the infested plots and the means of the yields from the uninfested plots showed that webworm attack reduced the production of grasses by 85 per cent. (30 cwt. per acre) and the total production of the pasture by over 50 per cent. (24 cwt. per acre).

(b) *1950 Yields*

The results in the second year were more complex. The residual effect of DDT applied at a concentration of 1 per cent. was apparently sufficient to suppress completely webworm damage to the pastures. Although there was some residual effect of DDT applied at a concentration of 0.5 per cent., webworm damage was nevertheless evident with a consequent reduction in grass yield. Applications at a concentration of 0.25 per cent. had little or no toxic effect in the second year and webworm attack practically eliminated the grass component. Few larvae were present in the untreated control plots but this may have been due to the lack of oviposition sites available during the late summer months following the elimination of the grasses the previous year. Observations in the field suggest that for the most part the moths oviposit where there is a good cover of dry grass.

A comparison of the yields from the heavily infested plots (0.25 per cent. DDT) and the uninfested plots (1 per cent. DDT) showed that webworm attack reduced the grass yield by over 80 per cent. (18 cwt. per acre) and the total production of the pasture by 17 per cent. (8 cwt. per acre). The yields of subterranean clover were much higher in

†The yields from plots treated at different times have been bulked since the effect of this factor was negligible.

the second year, due apparently to more favourable seasonal conditions, a good clover season being experienced throughout the area. The values were rather erratic but in general followed a trend, depending upon the intensity of the competition from the grass species. The high capeweed yield in the control plots may have resulted from more favourable conditions for establishment caused by the reduced cover of dry grass in the previous summer but it is also possible that these plots contained a higher level of nitrogen due both to the greater production of clover in 1949 and to the deposition of excreta by the larvae. The reduced yields of capeweed with higher rates of DDT application were no doubt primarily a reflection of increased growth of volunteer grasses. In the treated plots the trend in the total production of the pasture showed an increase with increasing amounts of DDT applied and followed closely that of the grass yields.

Discussion

Similar results to those described above were obtained in large-scale field treatments in which the pastures were grazed throughout the season. Here DDT/superphosphate mixtures at concentrations similar to those used in the above experiment were applied by means of a drill during the late summer months. Good control of the webworm was obtained in all treatments. The foliage yield figures obtained, although unsuitable for statistical analysis, indicated that webworm attack on the untreated areas had reduced the yield of grasses by 88 per cent. (11½ cwt. per acre) and the total production of the pasture by 40 per cent. (15 cwt. per acre). The red-legged earth mite was also present in these pastures but the damage caused by this pest would be masked by the grosser effects of the webworm.

It is apparent that the presence of the webworm may have a considerable effect on the growth and botanical composition of pastures in the southern wool-growing areas of Western Australia and at times it may be considered practicable to carry out control measures. The experimental results indicate that DDT is highly toxic to the webworm larva and that control can be achieved by applying very small amounts of this insecticide during the late summer months. DDT mixtures can be readily prepared with superphosphate and applied during the routine top-dressing of pastures by means of a broadcaster or drill.

Acknowledgments

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TRICHLOROACETATES AND OTHER HERBICIDES FOR THE CONTROL OF JOHNSON GRASS (Sorghum halepense (L.) Pers.) AND COUCH GRASS (Cynodon dactylon (L.) Pers.)

By R. M. MOORE and L. F. MYERS

Summary

Several herbicides reported to be toxic to grasses were applied to old established stands of Johnson grass and couch grass.

In two experiments ammonium trichloroacetate gave complete control of Johnson grass and couch grass and did not prevent the establishment of several other species four months after application. Allyl mixed chrorophenyl carbonate, isopropyl 2,4,5-trichlorophenoxyacetate, diesel distillate and lighting kerosene had no permanent effects on either Johnson grass or couch grass.

In other experiments, trichloroacetates gave poor results and evidence is presented that rain, within a short period following application, may govern the herbicidal effectiveness of these compounds.

Introduction

Johnson grass (*Sorghum halepense*) and couch grass (*Cynodon dactylon*) may be serious weeds in Australia, particularly in irrigated orchards. High summer temperatures and regular irrigation provide ideal conditions for the growth of both species.

It has been reported that salts of trichloroacetic acid (McCall and Zahnley, 1949) and hydrocarbon oils (Arle, 1950) gave promising control of Johnson grass. Allyl mixed chlorophenyl carbonate (Goodrich, personal communication 1948) has also been suggested as a possible herbicide for the control of unwanted grasses.

The experiments reported herein were designed to test these and other compounds on established stands of Johnson grass and couch grass.

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Experimental methods and results

(a) *Johnson grass*

A uniform stand of Johnson grass at Leeton, New South Wales, was divided into plots 20 links by 7½ links and the following treatments applied, October 18, 1949.

1. Control—no treatment.
2. 0.075 per cent. allyl mixed chlorophenyl carbonate (AMCC) in lighting kerosene.
3. 0.15 per cent. allyl mixed chlorophenyl carbonate (AMCC) in lighting kerosene.
4. 0.30 per cent. allyl mixed chlorophenyl carbonate (AMCC) in lighting kerosene.
5. 0.60 per cent. allyl mixed chlorophenyl carbonate (AMCC) in lighting kerosene.
6. 1.2 per cent. allyl mixed chlorophenyl carbonate (AMCC) in lighting kerosene.
7. 0.60 per cent. allyl mixed cholorophenyl carbonate (AMCC) plus 1.2 per cent. "Solubilizer"* in water.
8. 10 per cent. ammonium trichloroacetate (TCA) in water.
9. Lighting kerosene (B.R. 161-268°C. Aromatics 6.5 per cent.).
10. 0.30 per cent. isopropyl 2,4,5-trichlorophenoxyacetate in lighting kerosene.
11. 0.30 per cent. isopropyl 2,4,5-trichlorophenoxyacetate in water.
12. Diesel distillate (B.R. 181-352°C. Aromatics 20.4 per cent.).

*A commercial dispersing agent.

Treatments were applied as foliage sprays at rates equivalent to 200 imperial gallons per acre. Plots were arranged in four randomized blocks.

No attempt was made to test frequency of spraying with the petroleum oils, lighting kerosene and diesel distillate. Lighting kerosene was applied alone, to differentiate its effects from other treatments in which it was used as a carrier. Diesel distillate was included as it was known to kill top growth of grasses and therefore could be used as a reference treatment to compare relative rates of recovery.

The effect of treatments was determined by counting the number of tillers produced on three quadrats (2 x 2 links) per plot at monthly intervals following spraying. The counts are given in Table I.

The above-ground parts of Johnson grass sprayed with TCA died within three weeks and there was no subsequent re-growth. With the exception of AMCC in water and the trichlorophenoxyacetate in water which produced only local foliage injury, the other treatments completely killed the top growth but did not prevent re-growth of new tillers. Diesel distillate killed top growth more rapidly than lighting kerosene but neither inhibited re-growth. AMCC and isopropyl 2,4,5-trichlorophenoxyacetate increased the speed of top kill by lighting kerosene without decreasing the subsequent re-growth.

An inspection on November 3, 1950, approximately 12 months after spraying, confirmed the complete eradication of Johnson grass by TCA. All other treated plots could not be distinguished from the controls.

(b) *Couch grass*

An experiment of similar design with identical treatments was laid down on

TABLE I

Number of Johnson grass (Sorghum halepense) tillers before and after treatment with herbicides. Totals of three 2 × 2 link quadrats per plot (Means of four replicates).

Treatments. (All applied in 200 gallons of carrier per acre)	Tiller counts.		
	18th October — before spraying.	11th November — 1 month after spraying.	21st December — 2 months after spraying.
Control	61	90	80
.15% allyl mixed chlorophenyl carbonate in kerosene	97	36	70
.30% „ in kerosene	106	46	72
.60% „ in kerosene	79	26	41
1.20% „ in kerosene	84	31	51
2.40% „ in kerosene	110	30	66
1.20% „ in water	86	99	91
.30% isopropyl 2,4,5-trichlorophenoxyacetate in kerosene	61	17	37
.30% isopropyl 2,4,5-trichlorophenoxyacetate in water	125	101	101
10% ammonium trichloroacetate in water	97	0	0
Lighting kerosene	71	30	39
Diesel distillate	94	35	62

TABLE II

Incidence of rainfall before and after spraying in relation to control obtained with trichloroacetates.

Species.	Rate of TCA (lb. per acre)	Rainfall (inches)			No. of days from treatment to first fall of rain exceeding 0.25 in.	Remarks.
		Period 14 days before treatment applied.	Period 14 days after treatment applied.	Period from 14 days to 28 days after treatment applied.		
Johnson grass	200	0.94	1.14	1.27	5	Complete control. No re-growth 12 mths after spraying.
Johnson grass	50-600	1 95	0.09	0.06	55	No control.
Couch grass	200	. 2.56	0.47	0	14	Complete control. No re-growth 12 mths after spraying.
Couch grass	200	0.70	0	128	28	10-15% re-growth 3 weeks after spraying.

established couch grass at Canberra, March 14, 1949. Similar results were obtained as with Johnson grass; TCA alone gave complete control. As in the Johnson grass experiment the compounds dissolved in lighting kerosene increased the speed of kill of the top growth but did not reduce subsequent tiller formation. Two months after spraying, *Salvia verbenacea* and *Hypochaeris radicata* had produced re-growth on the TCA plots.

(c) *Additional experiments with TCA*

Following the success achieved with TCA, the investigation was extended to determine the effect of rates of application. In one experiment, rates as high as 600 lb. per acre failed to kill Johnson grass. In another, couch grass was not controlled by TCA at rates up to 200 lb. per acre.

An examination of the factors responsible for these variable results indicated that rain following spraying appeared to govern the effectiveness of TCA as a herbicide. In Table II, evidence of the relationship of the herbicidal effectiveness of TCA to the incidence of rain before and after application has been assembled from the several experiments.

From Table II it is seen that in the two experiments where control was obtained significant falls of rain (more than 0.25 inches) occurred 5 and 14 days respectively, after treatments were applied. Where no rain exceeding 0.10 inches fell until 55 days after treatment, rates up to 600 lb. per acre gave no control of Johnson grass. In the second couch grass experiment rain did not fall for 28 days after application, by which time regrowth had already occurred and there was no subsequent effect from the TCA. Rainfall prior to treatment did not appear to influence the herbicidal effectiveness of TCA.

Discussion

The evidence presented of the relationship of TCA toxicity to rainfall is in general agreement with the opinions expressed by other workers (Barrons, 1949; Anon., 1949). The herbicidal effectiveness of TCA appears to depend on direct contact of a relatively high concentration with roots, rhizomes and other perennating organs. It is to be expected, therefore, that apart from the quantity of TCA applied, both the amount of rain and time it is received after treatment will have important effects on the degree

of control achieved. If foliage applications are made, rain is probably required for removal and transport of the salt from the leaves to the rhizomes. Unless sufficient rain for these purposes is received within a short period, there may be a loss of toxicity due to "trapping" of the TCA in leaves and to break-down in the soil (Loustalot and Ferrer, 1950).

Although their dependance on rain is a disadvantage, trichloroacetates are promising herbicides for rhizomatous grasses.

Experiments are in progress to determine minimum effective dosage levels and to obtain direct evidence of the relationship of TCA toxicity to rainfall.

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SEEDLING BLIGHT. V — A NEW SOIL MOISTURE RELATIONSHIP TO THE DISEASE IN PEAS

By H. R. ANGELL

Summary.

If peas are sown in air-dried local experiment station soil which is watered only once, either before or immediately after sowing, emergence is about 60 per cent. However, if the same quantity of water in the soil at sowing time is given in two applications, one of them a week or more before sowing, and the other immediately after sowing, emergence is much less, being sometimes as low as 26 per cent.

If the second lot of water is applied at sowing, and the soil is stirred to distribute the moisture evenly throughout the mass, emergence is substantially improved, but is less than if the water is given in one application at sowing.

The given variations in percentage emergence are due to the influence of different watering methods on seedling blight caused by *Pythium* spp.

Introduction

Reports by Jones (1931), Bayliss (1941) and Flentje (unpublished work) on soil moisture in relation to seedling blight of peas were concerned with different percentages of soil moisture at sowing time. The results here reported were obtained in pots in which the percentage of moisture in the soil at sowing time was the same. The contrasts were associated with applying water, either all at once or in two instalments (the second instalment being after sowing) and with or without stirring the soil thoroughly after watering at sowing time.

Materials and methods

The experiment was made in a basement in the laboratory of the Division of Plant Industry. In the basement, the changes of temperature throughout the year were from about 16°C. in winter to 24°C. in summer. Illumination was by 100-watt tubular fluorescent lamps and averaged 300-foot candles at pot level.

Experiments and results

In the first experiment air-dried soil weighing 2.5 kg. from the C.S.I.R.O. Experimental Station, Canberra, A.C.T., was placed in each of thirty pots. Five levels of water, 100, 200, 300, 400 or 500 g. were applied to twenty-five of the pots. These watered pots and the five air-dry controls were then set aside and left undisturbed until the moisture content of those which received 500 g. was decreased by evaporation to the equivalent of one-third of the moisture-holding capacity. Twenty garden pea seeds (var. William Massey) were then sown in each pot. After covering the seed, the total moisture content of all other pots than those which received 500 g. initially was adjusted to the equivalent of one-third of the moisture-holding capacity. The total moisture content of all thirty pots was therefore the same, but its distribution was different, on the date of sowing.

The experiment was repeated nine times during the course of the year. The time required for evaporation of water in excess of the percentage required at sowing time depended on weather conditions and whether or not the fluorescent lamps which raised the temperature of the soil slightly, were turned on or off.

The results of the nine experiments are summarised in Table I. The differences in percentage emergence from pots to which water is applied only once, either before, or at sowing time, are insignificant. There is a significant depression in emergence from all pots which received two applications of water.

In another series of experiments, pots of soil were initially watered, as already outlined, and set aside. Five air-dry controls were also provided. They were

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TABLE I

Percentage emergence of peas from soil watered differently initially but adjusted by surface watering to a common total moisture content at sowing time. Means of nine experiments.

	Air dry until sown	100 g. water initially	200 g. water initially	300 g. water initially	400 g. water initially	500 g. water initially
Means	64	34	28	26	40	58
Trans. values ..	53.5	35.8	32.1	30.8	39.2	53

Minimum difference between transformed values significant at 5% = 4.1.

left until the total moisture remaining in those pots which received 500 g. initially was reduced to the equivalent of one-third of the moisture-holding capacity. The moisture content of all other plots was then adjusted to equal this. The soil in each set of five pots was then tipped into, and mixed, in another vessel to distribute the moisture more uniformly throughout the mass. After re-potting, peas were sown.

The results in Table II show that if two applications of water are made, stirring the soil at sowing time to distribute the moisture throughout the mass influences the percentage emergence of peas, making it higher than from unstirred soil. The percentage emergence

TABLE II

Percentage emergence of peas from soil with moisture uniformly distributed or applied to the surface on the date of planting. Means of three concurrent experiments.

		Air dry until sown	100 g. water initially	200 g. water initially	300 g. water initially	400 g. water initially	500 g. water initially
Water uniformly distributed	Means	73	63	53	52	48	52
	Trans. Values ..	58.6	52.3	46.5	46.0	44.1	46.7
Water applied on surface	Means	63	28	26	25	29	55
	Trans. Values ..	52.6	31.6	30.4	29.7	32.6	42.4

Minimum difference between transformed values significant at 5%=8.6.

from the pots of stirred soil which were kept air dry until sowing time is significantly higher than from all other pots of stirred soil which were treated otherwise, excepting those which received 100 g. of water initially.

Discussion

The differential response of peas to variation in methods of watering indicates how delicately balanced is the susceptibility of this species to water relationships in unsterilized soil. If, however, the pathogens, *Pythium* spp. (Angell, 1951) are eliminated by steaming the soil, uniformly high percentage emergence is obtained, notwithstanding the variations in the watering methods here described.

Unpublished results of experiments with soils from which emergence is usually excellent, and other soils from which emergence is very poor, show that differential reaction to the watering methods here described will be weak in the former class and not evident in the latter. Other factors in the environment in such soils obscure the effects of watering methods. Soils which are likely to respond in a similar manner to the one used in the work here reported are those from which emergence is somewhat variable, the mean being about 65 per cent.

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COMPARATIVE HAY YIELDS OF VARIOUS ANNUAL MEDICS IN THE YEAR OF ESTABLISHMENT

By F. W. HELY and W. J. C. HUDSON

Summary

Several aspects of the nature of Common Burr Medic (*Medicago hispida* var. *denticulata* Gaertn.) and Barrell Medic (*Medicago tribuloides* Desr.) and discussed with emphasis placed on the need for the selection of improved strains of Barrel Medic for commercial distribution.

An experiment conducted at Wagga Agricultural College and Experiment Station involving the testing of sixty four trains of annual legumes (mostly species of *Medicago*) is described.

The lattice method of design and a harvesting technique for the testing of a comparatively large number of strains with limited resources available is discussed.

It was found that considerable variation exists between and within species of *Medicago* with respect to hay yields.

Several strains of Barrel Medic (*M. tribuloides*) tested at Wagga proved to be better than commercial material in yield of hay.

Introduction

Of the ten well-recognized species of *Medicago* which have become naturalized in Australia, the Common Burr Medic (*Medicago hispida* var. *denticulata*) is the most widely distributed and best known. Under good seasonal conditions and on fertile soils it makes luxuriant growth, normally nodulates well and presumably is instrumental in the fixation of appreciable amounts of atmospheric nitrogen; furthermore it withstands quite wet conditions during winter months on "heavy" river flat and plains country. On the other hand its hook-spined pods (or "burrs") which adhere readily to a sheep's fleece are comparatively expensive to remove from wool. The average Australian material of this species is lacking in drought hardiness and deteriorates rapidly once the warm weather comes, and it is rather well known for its photosensitization effects (Hurst, 1942). Much of the investigational work done on annual medics in Australia has had as its objective the development of material superior in one or more respects to the ordinary type of Common Burr Medic.

Probably the most important advance in this field was made when Barrel Medic (*Medicago tribuloides*) was popularized (Trumble, 1939) and the commercial production of its seed was undertaken in South Australia during the last decade. It does not respond so vigorously to good growing conditions as does the former but normally it is much better under seasonal conditions of a rather poorer than average nature. In addition, although its pods are mostly well provided with spines, such spines are unhooked; for this reason and also because of the much greater pod density the "burrs" of this species are much less likely to adhere to a fleece, or once there they fall out or are more readily knocked out during the passage of sheep through cereal stubble or other herbage. In addition, whereas the pod material of Common Burr Medic is very fibrous and difficult to remove from wool, the pods of Barrel Medic are so brittle, when dry, that they can be crushed to a powder if the fleece is passed through Peralta rollers.

Almost all of the annual medic seed sown in Australia during recent years on grazing land or, more usually, farming land being put down to temporary ley, has been that of Barrel Medic. Unfortunately

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there are no recognized strains or varieties of this species available commercially. The seed is harvested, mostly in South Australia, from selected areas of naturally-occurring material. Efforts have been made, and are still being made, to define strain variation in this material so that inferior types can be excluded from commercial production. With the development of seed production of this species from recently introduced material in areas where it has not been important previously, the selection of superior strains for subsequent wider distribution has become an urgent consideration.

At the same time the simplification of testing procedure to allow comparatively large numbers of medic strains to be tested critically with limited resources is an important consideration.

This article reports findings with respect to hay yields from replicated ungrazed plots of annual medics in their season of establishment at the Wagga Agricultural College and Experiment Station in 1949.

Materials and methods used

The soil type on which the investigations were carried out was a partly podzolised red brown earth, which had been supplied with approximately 2 cwt. superphosphate per acre just prior to the sowing of seed. It had been well fallowed and consequently was apparently provided with sufficient nitrate nitrogen.

Seed lots of sixty medic strains were sown. Of these twenty six were strains of *M. tribuloides* and the rest consisted mainly of related species—*M. obscura, M. murex, M. turbinata, M. rigidula* and *M. tuberculata.* Also included were—one strain of *M. hispida* var. *denticulata,* seven other representatives of *M. hispida,* three varieties of *Trifolium subterraneum* and one of *T. glomeratum* (the main naturally occurring annual legume).

This experiment of sixty four strains was designed as a lattice experiment with four replications according to the method of Cox, Eckhardt and Cochran (1940). Each plot measured 20 links by 20 links with dividing lanes 5 links wide. Seed was sown by hand in rows 2 links apart in such a way as to ensure the early development of a full cover of legume. Rate of seeding for *M. tribuloides* was approximately 5 lb. per acre of readily germinable seed and rates for other species were varied to keep the number of viable seeds per acre constant. A row of *Phalaris tuberosa* L. was drill-sown along the centre of the dividing lanes as a precaution to prevent the mixing of one strain with another, and to define plot borders.

The trial was sown at the beginning of May, 1949. Average winter and good spring conditions favoured the longer season medics and were suitable even for Mount Barker subterranean clover, which is considered marginal for this environment. All plots received one weeding during the growing season.

The facilities available for determination of comparative hay yields necessitated the development of a technique which would make it possible to get a comparatively large number of yields determined in a short time. The method used was to carefully select standards noted on a 1-5 basis. The remaining plots were then related to these standards by placing a 5 link by 5 link quadrat frame in each corner of each plot. These were not strictly at random but at a fixed distance in from the plot edges. In all cases a score, on the 1-5 basis was given for each of the four quadrats, referring frequently to the standards for guidance. Finally the quadrats from the standard plots were cut, carefully sorted, oven dried at 160°F. and weighed. From these determinations legume hay yields were estimated.

The estimated yield for each plot was arrived at by replacing the score allotted to each of the four quadrats by the dry weight obtained from the standard plot of corresponding score.

The errors of estimate using this method of yield assessment are not known.

However, an analysis of variance of the estimated plot yields showed that the calculated minimum significant difference at the 5 per cent. level is 6.5 cwt. per acre.

Discussion

There was considerable variation in estimated yield, both between and within species. In the Barrel Medic (*M. tribuloides*) group hay yields ranged from 39.6 cwt. per acre (M. Trb-175), to 25.2 cwt. per acre (M. Trb-178), and ample scope exists for the selection of higher yielding strains for subsequent commercial distribution.

It appears that several strains of *M. tribuloides* tested at Wagga are superior to the two commercial selections, M. Trb-178 and M. Trb-357.

High figures were obtained with many of the strains but for any final selection programme other characters, apart from hay yield, must be taken into consideration. Such characters would include seed yield, length of season, nature of pod spines, water efficiency, effective nodulation, rate of establishment, shade tolerance and competitive ability, ease of harvesting pods, and of extracting and processing the seed.

The design used for the trial proved most satisfactory and is suited for the comparison of large numbers of treatments (in this case sixty-four) as it minimizes error due to differences between blocks.

The method of yield assessment employed is considered likely to be of value in circumstances where a large number of hay yields is to be determined with a minimum of delay, facilities and labour. Although the figures obtained do not represent actual yields they are far superior to ordinary estimates.

The experiment at Wagga Agricultural College will be continued, maintaining the same plots, and an attempt will be made to collect information on hay production and general performance when grazed by sheep.

Acknowledgments

The authors are indebted to Dr. D. B. Duncan and Mrs. L. M. Evans, both previously of Sydney University, for their advice and assistance in experimental design and statistical analysis of results.

Moreover, the contributions by Messrs. F. C. McCleery, N.S.W. Department of Agriculture, W. Andrew, C.S.I.R.O., and G. A. McIntyre, C.S.I.R.O., are sincerely appreciated.

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AN APPARATUS* FOR CUTTING AND TREATING PLANT (OR ANIMAL) TISSUE IN ONE OPERATION

Introduction

The apparatus described below was developed in relation to studies on the chemical control of the tobacco suckers which grow as a result of the topping operation. It is commercial practice to remove the tobacco inflorescence. This is known as topping and is followed by five to seven routine trips around the crop to remove the suckers which then develop. Topping increases the growth of the upper leaves but unfortunately also stimulates the axillary buds to develop.

Tobacco plants grown under glasshouse conditions have been treated with growth regulators at topping time and in several experiments the sucker growth has been effectively controlled. The growth regulators in these experiments were applied to the cut stump with a small brush or from a dropper.

Following the effective control, under glasshouse conditions, field experiments were carried out in North Queensland during the two seasons 1950 and 1951. The results of this work will be described separately. The chemical inhibition of sucker growth eliminates the necessity for the frequent rounds of the crop to remove the suckers. Even though this chemical control of suckering involves a considerable saving of labour, the operation of topping and separately applying the regulator to each individual plant is considered cumbersome. Hence the im-

*Patent applied for.

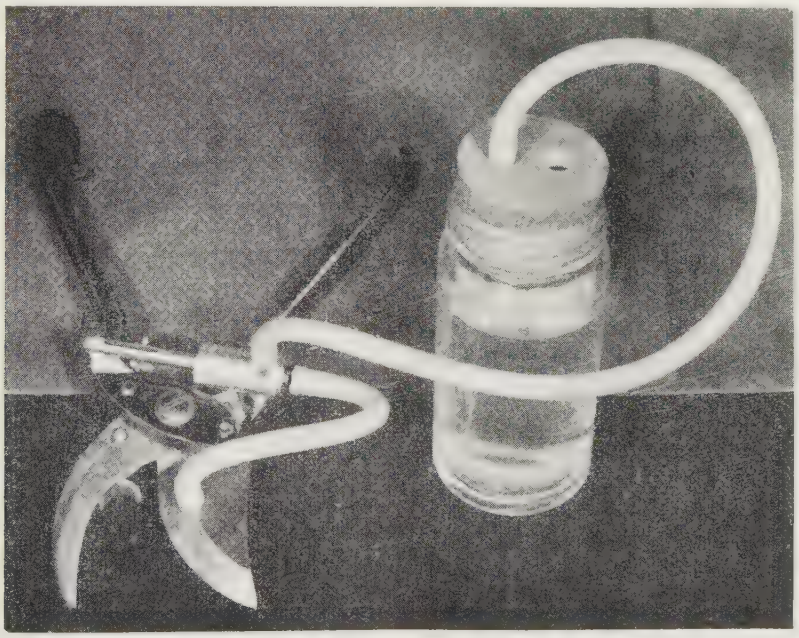

Figure 1.
General view of the pump mounted on secateurs. The inlet and outlet valves are connected with the reservoir and the cutting blade respectively.

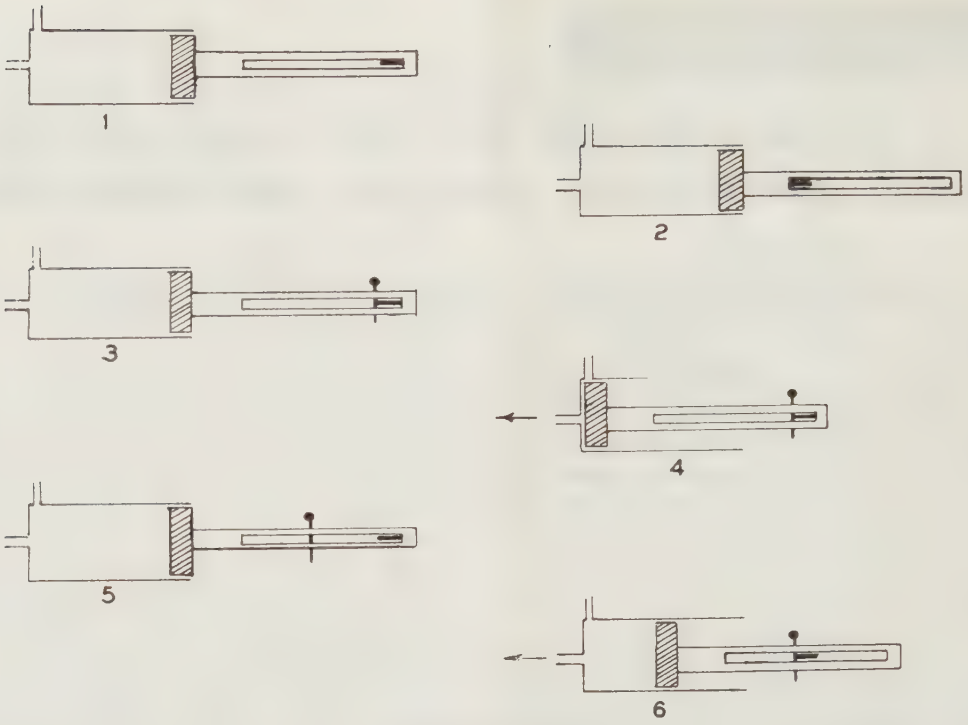

Figure 2.
Secateurs in open position for diagrams 1, 3 and 5, and in the closed position for 2, 4 and 6.

mediate object of the invention was to provide the tobacco grower with an apparatus, easily manipulated, which would simultaneously, or almost so, top the plant and treat the cut surface with the appropriate growth regulator.

Description

In the working model, ordinary spring loaded secateurs were utilized. On the fulcrum end of one handle a small cylinder is mounted on a rotatable axis. Into this cylinder a piston or plunger is inserted. The piston rod or spindle has a longitudinal slot along the greater part of its length. A motivating pivot, which can rotate in the same plane as the cylinder, is mounted on the other handle. This pivot has a flattened extension, which fits into the slot of the piston rod and can move freely along its length. There is a series of holes along the length of the piston rod and at right angles to the slot. A small pin in any of these holes governs the stroke of the pivot extension along the slot in the piston rod, and hence controls the dosage. On the other end of the cylinder are two spring loaded valves, one an inlet and the other an outlet. The inlet valve is connected by flexible tubing to a reservoir of the liquid to be applied. A flexible connection is provided between the exit valve and an orifice in the upper or cutting blade of the secateurs. On the underside of the other blade, a stop or guide is mounted, so that any tissue in the process of cutting, or immediately after, will pass directly under and across the orifice. Figure 1 gives a general view of the apparatus.

Action of the pump

Assume that the handles of the secateurs are in the open position. The flat extension on the pivot associated with the piston rod will be at the outer end of the piston rod and the plunger will be

fully retracted in the cylinder (see diagrams 1, 3 and 5 of Figure 2). If the pin is not in any of the holes along the length of the slot, then closing the secateurs causes the flattened extension of the pivot to move the full length of the slot in the piston rod, and there is no action on the piston (Figure 2, Diagram 2). If the pin is inserted in the hole in the piston rod closest to the pivot extension, any movement of the secateur handles will cause the piston to move. Closing the secateur handles discharges the full dose (Figure 2, Diagram 4).

If it is not desired to eject any liquid before the actual cut, but rather to dispense it as the orifice moves across the cut surface, then the pin may be inserted in some selected hole on the piston rod. By suitably positioning the pin, the piston can be made to move forward in the barrel only as the orifice approaches the cut edge of the partly severed tissue. In this instance, the initial movement of the handles merely causes the pivot extension to ride along the slot in the piston rod until it reaches the pin, further movement then discharges the liquid over the cut surface (Figure 2, Diagram 6). The position of the pin along the piston rod determines the extent of the dose to be discharged. After the cutting operation the spring returns the handles to the open position, thereby retracting the piston, which in turn automatically refills the cylinder from the reservoir. The reservoir may be carried in the pocket or on a sling around the neck.

Other uses

The apparatus could be used to treat vines suffering from zinc deficiency. The spur pruned types of vines (Gordos and currants) have their cut surfaces treated with zinc sulphate solution at the time of pruning. This operation is common practice in South Australia and it increases the pruning time by 30 to 50 per cent.

The apparatus can also be used in the routine pruning of other plants when it is desired to apply a protective or fungicidal preparation. Insertion of a spray nozzle in place of the open orifice in the cutting blade would enable individual branches or twigs to be sprayed during pruning. A simple modification in the shape of the cutting blades would make the apparatus suitable for treating lambs' tails with an antiseptic preparation when docking, or at least permit the irrigation of the blades with an antiseptic during each operation.

It has been suggested that the principle may be of value in the control of Brigalow (*Acacia harpophylla*). There are some millions of acres of good land in Queensland occupied by Brigalow. Easterbrook (1951) has controlled Eucalypt seedlings and suckers with herbicides of the hormone type. Frill-poisoning and swabbing were equally efficient but the latter was preferred because it was generally quicker. A knapsack spray with a single Cyclone nozzle was used to apply the hormone. It is stated that a high pressure should be maintained and a quick, efficient cut-off value is essential. It is suggested that the principle described above could be utilized in this type of work.

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ANOMALOUS WOOL GROWTH IN A MERINO FLEECE

Wool from the withers of a Queensland two-tooth merino showing adjacent growth typical of two distinct wool types, has recently been submitted to this laboratory. Staples of "lustre wool" appearance were produced on a limited skin site, at whose periphery, adjacent staples were of the contrasted lustre and merino types, the change being abrupt. In the former, the number of crimps per inch was 2 and in the latter of the order of 18. Measurement has disclosed the following, in adjacent staples:—

	Lustre type	Merino type
Mean fibre thickness ..	27.0 microns	18.2 microns
Minimum thickness	14.0 ,,	12.0 ,,
Maximum thickness ..	42.0 ,,	36.0 ,,
Coefficient of Variation of fibre thickness ..	24.0%	17.1%
Staple length	7.0 cms.	5.5 cms.
Mean fibre length	8.9 ,,	8.0 ,,
Minimum length . ..	3.0 ,,	6.5 ,,
Maximum length	12.0 ,,	10.0 ,,
Coefficient of Variation of fibre length	24.2%	9.3%

According to the Duerden scale (Duerden, 1929) relating mean thickness and quality number, the two samples were 56's and 70's respectively. The mean fibre lengths are surprisingly close, despite a decided difference in staple length. The lustrous appearance of the fibres of the

anomalous growth and its variability of fibre thickness and fibre length are the outstanding characteristics.

It is believed that this phenomenon is rare in occurrence or at least, because of its undesirability, rarely reported. Ross (1933) and Bosman (1935) have described two other cases. In the former, in a 64-66's merino fleece from the Western District of Victoria, both types of growth were somewhat coarser than herein reported, but generally the contrast was of the same order. In the latter, a distinctive band of longer staples grew transversely across the back of the sheep. It was only slightly coarser than the normal growth, although the difference in crimping was marked.

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(*Received for publication March* 10, 1952)

BOOK REVIEW

VEGETABLE GUMS AND RESINS

By F. N. HOWES

(*Chronica Botanica, Waltham, Mass., and N. H. Seward, Melbourne*, 1949, 188 *pp.*)

This book is number 20 of the Chronica Botanica's new series of plant science books. Dr. Howes, a botanist, is Principal Scientific Officer at the Royal Botanical Gardens, Kew, and his book is different from most recent books on gums and resins in that particular attention is paid to the botany of the numerous species discussed. The book contains thirty-nine line drawings of the more important species. Part 1 of the book discusses the nature and uses of gums and describes their geographical and botanical sources, collection, marketing, bleaching and grading. The Acacia and Tragacanth types are dealt with very fully and twenty-two Asiatic gums are described in less detail. A short chapter describes eight gum-yielding genera from the Americas and the final section discusses little known gums from 67 genera.

Of the resins, colophony, the copals, dammars, elemis and Kauri are dealt with in detail. Sandarac, mastic, dragon's blood and accroides are more briefly treated; there is a short chapter on natural lacquers and a few pages on frankincense and myrrh which are apparently still used commercially.

Although lac is an insect secretion it is included in the book because it is always formed on plants and has many points of similarity with vegetable resins. The final chapter describes the resins from thirty-four genera.

From a technical viewpoint the discussion of chemical properties and industrial uses is disappointing. For example, pine resin or colophony is used in large quantities to make ester gum, an important constituent of paints and lacquers, yet this product is not mentioned under the uses of colophony.

An otherwise excellent chapter on the production of oleo-resin from *Pinus* species fails to mention the fact that modern American practice uses sulphuric acid as a stimulant to produce resin flow. This technique, first suggested in the thirties by German and Russian workers, has been perfected in the U.S.A. and by increasing resin yields has been of very great benefit to the industry. Experiments using acid sprays are now being carried out in France and some work has also been done in New South Wales in plantations of Slash Pine (*Pinus caribaea.*)

The Australian worker will be impressed with the wide range of plants from this continent which exude gums or resins. With the exception of grass tree resin from *Xanthorrhoea* species these products are of no economic importance, a fact which probably explains why they have so far been neglected by the organic chemist. There is a big field for research here and it is to be hoped that workers co-operating in the C.S.I.R.O. sponsored phyto-chemical survey will eventually give some attention to these interesting exudations.

Two indices are included, one containing over 500 botanical names, the other listing common names and authors cited. A few minor errors were noted in the text but, generally speaking, the book is well produced. It can be confidently recommended to all those interested in this field of research or commerce.

L. H. BRYANT.

A SAMPLING TECHNIQUE FOR UNDERGROUND GRASS GRUBS

During work on the insecticidal control of the corbie, *Oncopera intricata* Walk., it was found necessary to obtain an estimate of the grub populations.

Sampling in the first season was carried out by digging foot square samples down to a depth of one foot, hand sorting the soil, and counting the number of grubs present.

In the second season the number of plots was increased six-fold from 24 to 144, and it became necessary to evolve a technique enabling speedier sampling if the populations of grubs in all plots were to be estimated within a reasonable time.

Some thought was given to the possibility of counting the number of grub holes on the surface of the turf. However, no reliable counts could be obtained because the entrances to the vertical burrows were hidden, either in tufts of grass or by the webbing of the surface runways.

The top inch of soil and pasturage was shaved off to determine whether the vertical tunnels could be exposed, but they tended to become blocked up with soil in this operation. The sampling difficulties were finally overcome by a modification of this method.

After the top inch of soil and pasturage had been removed any exposed holes were loosely plugged with soil and a metal plate one foot square was placed on the bared ground (Figure 1). The plate was lifted the following day, exposing the opened grub holes where the larvae had attempted to emerge and feed (Figure 2).

Initially, the plates were left down for 72 hours, examinations being made after 24, 48 and 72 hours. It was found that almost invariably all holes were opened after 24 hours. Counts of the actual number of grubs present were obtained by digging out the soil and counting the grubs. Excellent agreement was obtained

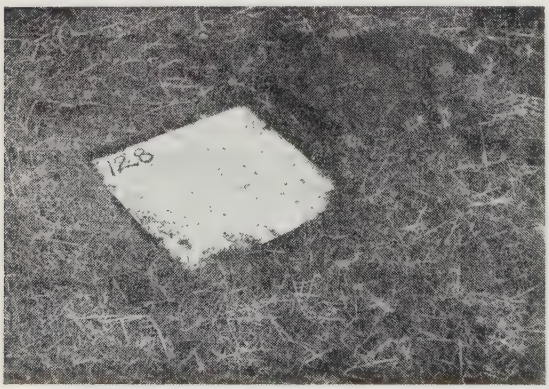

Figure 1.
Metal Plate in position.

Figure 2.
Plate lifted 24 hours later exposing opened grub holes (marked by arrows).

between the number of grubs and the number of holes opened.

This method would be useful for sampling of soil inhabiting insects that emerge regularly at night to feed. For intermittent feeders, such as *Aphodius* spp., it would seem to be of doubtful value.

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(*Received for publication May 5, 1952*).

BOOK REVIEW

PLANT VIRUSES AND VIRUS DISEASES

By F. BAWDEN

(*Chronica Botanica, Waltham, Mass., U.S.A., and N. H. Seward, Melbourne. Third revised edition*, 1950, 335 *pp.*, $ 6.00)

When "Plant Viruses and Virus Diseases" by F. Bawden first appeared in 1939 it was hailed as a timely and critical appraisal of our knowledge of viruses. It was the first book of its kind which dealt in detail with the viruses themselves, their properties and reactions *in vivo* and *in vitro*. Many of the points raised then were highly controversial as was only to be expected because the study of these infectious agents was in a transitional stage. The volume of research work which was going on in the virus field was such that by 1942 when a second revised edition of Bawden's book was issued, it was possible to give a much more rounded off picture of some aspects of the virus problem. Since 1942 many further changes in outlook have occurred and consequently it was with interest that a third edition, published in 1950, was examined.

Outwardly the format remains much the same as the earlier editions, apart from some re-ordering of chapters and the inclusion of one new chapter, but the text shows very considerable evidence of revision and correction to bring it up to date.

The opening chapter serves as an admirable precis of the whole book in that it defines a virus, discusses the nature of these infectious agents and their properties and outlines their economic importance. Various aspects are then developed in detail in subsequent chapters. Nine chapters are thus devoted to an account of the knowledge obtained by observation and experiment on what we may describe as the virus *in vivo*. Here is included an account of the symptoms, methods of transmission, relation to insect vectors, mutations, serological reactions and virus-host plant physiology.

Four chapters deal with the virus *in vitro* where methods of purification and the chemical and physical properties of the infectious agents are discussed. The remaining chapters give an account of the taxonomy of viruses, and of the principles of control of virus diseases together with speculations as to the origin of these pathogens.

Most of the chapters show some extension over those of the 1942 edition but the main increases and changes are shown in those parts dealing with methods of transmission, the relation between viruses and their insect vectors, and the virus *in vitro*. One new chapter on "Quantitative methods of assaying for viruses" has been introduced. This includes much material previously included in Chapters 2 and 7 of the 1942 edition, but sufficient new data was available for inclusion to warrant the change. Certain chapters have been re-ordered also. The placing of the account of estimation of particle size next to that on crystallinity is a happy change, but perhaps the same cannot be said of the final position adopted for "Virus diseases and host plant physiology."

In the Reviewer's opinion, also, the value of the book would have been added to by the inclusion in Chapter 2 of some *tabular* summary of the more important virus diseases, and their symptoms in the main differential host-plants.

Results of research work published up to the end of 1948 are included in the text and some attempt also has been made to include (in the form of footnotes) conclusions from important papers published in 1949. Such is the speed of change in some aspects of virus work, however, that already certain chapters could do with rewriting in the light of 1949-1950 researches.

The book is very well illustrated with photographs, many of high quality. It is to be hoped, however, that any later edition will include more illustrations in Chapter 2 for it is not to be supposed that it is only the specialist who reads this book. A slight blemish due to incorrect positioning of Figure 2 may be noted here. Instead of being on page 19, this illustration of a vacuolate inclusion should have been placed with its context on page 38 in the succeeding chapter.

Each chapter or group of chapters has its own comprehensive list of references and both the general index and author index have been carefully compiled. The book is very well produced and the vignettes add considerably to its attractiveness.

This is a very lucidly and critically written book by a master in the field of plant virus research. It successfully interprets progress therein and in its revised form will continue to serve as a valuable source book to the specialist. It can also be recommended with confidence to the non-specialist who wishes to obtain a picture of the modern virus position.

B. J. GRIEVE.

E. J. UNDERWOOD — PRESIDENT AND WINNER OF AWARD OF MERIT, 1952

The President of the A.I.A.S. for 1952-53 is Professor E. J. Underwood, Director of the Institute of Agriculture, University of Western Australia, who has the added distrinction of being the recipient of the Australian Medal of Agricultural Science for 1952.

In 1928, E. J. Underwood graduated with First Class Honours in the Faculty of Agriculture within the University of Western Australia, and obtained his Ph.D. in 1931, at the University of Cambridge where he worked under Dr. H. E. Woodman and Professor T. B. Wood. He subsequently held the positions of Animal Nutrition Officer at the Western Australian Department of Agriculture and part-time lecturer in the University of W.A. between 1932 and 1945. During this period he obtained world-wide recognition in scientific circles for his contributions to a number of animal nutrition and husbandry problems, including the Denmark wasting disease, botulism in sheep, pregnancy toxaemia and fat lamb production. The successful completion of these investigations not only had important local practical significance but added appreciably to basic scientific knowledge.

Between 1936-38 Professor Underwood gained further overseas experience, through the award of a Commonwealth Fund Service Fellowship, when he worked at the University of Wisconsin, U.S.A., on problems of mineral nutrition of animals and visited research centres throughout North America, the United Kingdom and South Africa.

At the beginning of 1946 he was appointed Hackett Professor of Agriculture, Dean of the Faculty of Agriculture and Director of the Institute of Agriculture at the University of Western Australia.

Over the last five years Professor Underwood has been responsible for the organization and development of teaching and research at the Institute of Agriculture which has now the largest graduate research group in any Australian University. A feature of this development has been the fine public and industry support which has been secured. He has also acted as Chairman of a Government Committee on Agricultural Education and Extension in Western Australia, which presented practicable short-term and desirable long-term plans for the development of an effective system of agricultural education and extension for the State.

In recent years he has been a member of a team of scientists investigating the much publicised and now widely known problem of "Sheep infertility on clover pastures." Investigations have revealed the nature of the problem, its control in the field by suitable management practices and have shown the presence in subterranean clover of an entirely new type of oestrogenic compound.

He has also initiated a wide programme of research within the Institute of Agriculture, particularly in relation to pasture plant breeding and genetics, economic and farm management surveys, factors influencing the nitrogen status of Western Australian wheat belt soils, the effects of rotation and cultural treatments on the "quality" of wheat and the role of ruminal micro-organisms in sheep nutrition.

Professor Underwood is a foundation member of the Institute of Agricultural Science and in 1935, was President of the Agricultural Scientists' Association of Western Australia, which body later became the Western Australian Branch of the Institute. He has five times represented the W.A. Branch at General Meetings of the Institute.

ANNUAL REPORT OF COUNCIL

Report of Council to the Eighteenth General Meeting held at C.S.I.R.O., Canberra on March 27, 1952.

Ladies and Gentlemen,—

Your Council has pleasure in presenting its Report for the year ending December 31, 1951, which is the sixteenth year of Institute activity.

Office-bearers for the year have been:

President . . . . . Dr. J. G. Davies
Hon. General Treasurer . . Mr. A. V. Hill
Hon. General Secretary Mr. G. A. McIntyre

	Delegate	Proxy
N.S.W. Branch	Mr. E. J. Breakwell	Mr. C. M. Donald
Vic. Branch	Dr. I. Phipps	Mr. K. Loftus Hills
Q'land Branch	Mr. N. E. H. Caldwell	Mr. C. Greenham
S.A. Branch	Mr. T. T. Colquhoun	Mr. C. H. Williams
W.A. Branch	Mr. L. C. Lightfoot	Mr. F. O. Grogan
A.C.T. Branch	Mr. P. A. Reid	Mr. C. Neal Smith
Tas. Branch	Mr. G. C. Wade	Dr. C. Barnard

Council met on nine occasions during the year. The President, who is resident in Canberra, was able to attend most of these meetings.

Fifteenth General Meeting

The Fifteenth General Meeting was held at Canberra on March 20, 1951, for the transaction of the formal business of the Institute. Reports were received, but discussion was restricted in view of the intention to review them at the Sixteenth General Meeting.

Sixteenth General Meeting

This meeting, which was held in conjunction with A.N.Z.A.A.S. at Brisbane on May 21/22, was well attended by representatives from all branches. One of the principal items of discussion was the question of the future development of the Institute. Other business before the meeting included reports on rural extension services in Australia, agricultural engineering training and research, A.I.A.S. scholarship scheme, conditions of employment, and new provisions for membership.

Seventeenth General Meeting

This special meeting was held on December 14 to consider alterations to Articles to change the subscription rate. A majority decision favoured empowering Council to alter the rate.

Development of the Institute

Interest in the immediate development of the Institute was aroused by a report prepared by the Victorian Branch advocating the appointment of a paid secretary and concomitant changes in the executive. A report by the Secretary and Treasurer favouring less drastic changes was distributed at the same time. The subject was vigorously discussed by the 16th General Meeting, which endorsed the principles of the Victorian report for Institute publicity, although the proposal for a central secretariat was not adopted. A special committee was formed to make recommendations to Council. Council has adopted a policy of two delegate-in-person meetings per year for a trial period, an increase in subscription rates, and a system of branch rebates to encourage increased activity within the branches.

Salaries and Status

Copies of the report of the survey on salaries and status conducted by the University of Melbourne Appointments Board were distributed before the Sixteenth General Meeting. The report was subsequently published in condensed form in the Journal.

Rural Extension Services

The report on rural extension services was discussed at the Sixteenth General Meeting and its recommendations adopted. The first three recommendations advocated the appointment of an experienced man to make a detailed survey of the state services. This view was conveyed to ministers of agriculture, who formally acknowledged the letter but made no comment, with the exception of the New South Wales Minister for Agriculture, who rejected the proposal. The fourth recommendation was that the Institute should attempt to formulate ideal standards for a rural extension service. Reports on particular aspects are now being received and collated.

Agricultural Engineering

The report prepared by the Institute was distributed to organizations likely to be interested in its recommendations. The Sixteenth General Meeting decided that arrangements be made for Professor Willis, of the New South Wales University of Technology, to meet the members of the Victorian Branch Sub-Committee. Following this meeting, held in September, Professor Willis made a report to the University. Copies of this statement have been distributed to branches for their advice and possible further action.

Conditions of Employment

The Victorian Branch at the Sixteenth General Meeting raised the issue once more of securing uniform conditions for superannuation, sick leave, long service leave, etc., between the state and Commonwealth departments and universities. In Council, it was decided that the most effective action could be taken at the Branch rather than Council level, and Council approves members of branches enlisting the support of other professional bodies whenever the opportunity arises to further the aims of greater uniformity and more freedom of interchange between organizations. Collated correspondence, between the Standing Committee of Scientific Bodies and government services and universities on interchange of superannuation rights, has been received and has been circulated to branches.

Institute and Standing Committee on Agriculture

The Sixteenth General Meeting considered a memorandum prepared by the A.C.T. Branch supporting the view that the Standing Committee be approached to admit the President of the Institute as an observer to its proceedings. This proposal was rejected by the meeting, and instead the Secretary was instructed to write offering the services of the Institute to the Standing Committee and indicating ways in which such help might be given. A reply was received from the Secretary to the Agricultural Council expressing appreciation of the offer.

A.I.A.S. Scholarship Scheme

There has been disappointingly slow progress with this scheme, but it would seem that the Institute is now on the eve of adoption of rules governing the scheme, the appointment of a finance committee and a supervisory committee. The Council took up with the Commonwealth Office of Education the possibility of a higher allowance in the honours year to encourage students in agriculture to advance beyond the pass degree.

A.I.A.S. Journal

During the year the quarterly issues of the Journal were published on schedule and were increased in size over the preceding year. A special and valuable issue to commemorate the Commonwealth Jubilee was produced in June and contributed to by noted specialists in the various fields of agriculture. The financial aspect of the Journal is not so satisfactory, and it is hoped that direct action now being taken to secure advertising will be successful.

Members of the Publications Committee during 1951 were:—

Honorary Editor	Mr. N. M. Tulloh.
Honorary Assistant Editor	Mr. P. F. Butler.
Honorary Business Manager	Mr. J. S. Orr.
Honorary Assistant Business Managers	Mr. I. McL. Eadie, Mr. P. M. Dexter.
Committee Members	Mr. R. D. Croll, Mr. J. A. Baker, Mr. H. G. Turner, Dr. N. S. Noble, and Dr. H. C. Forster.

Formation of Institute Opinion

Arising out of exception taken to particular features of the collation and presentation of the reports on Agricultural Engineering and Rural Extension Services, a Sub-committee of the Victorian Branch prepared a memorandum on the formation of Institute opinion. Only three branches have commented on this report, and it has been decided by Council to form a sub-committee to examine the possible alternative ways to achieve the best statement of opinion.

Members Proceeding Overseas

The question of subscriptions of members during their absence abroad has been the cause of much trouble to branch officials in past years. The matter was resolved at the Sixteenth General Meeting by an amendment to Article 6 empowering Council to reduce or waive the subscription of any member proceeding overseas for any purpose for more than one year.

By-laws of Council have since made provision for the automatic waiving of subscriptions for at most two years after the year of departure from Australia, the case to be reviewed at the end of the two years. The Journal, if desired, must be purchased by the member during the period of exemption.

Honorary Membership

The possibility of defining more exactly the qualifications for honorary membership was discussed. No definition was phrased but it was generally agreed that progress to a uniform conception of an acceptable standard had been made.

Emeritus Membership

Several branches disapproved of making special provision for retired members. However, there has been sufficient support for the idea, and agreement on the rules governing this class of membership for articles to be drafted. These will be put to the vote at the Eighteenth General Annual Meeting.

Affiliate Membership

The question of creating a class of affiliate membership, which has previously been before the Institute, was raised again at the Sixteenth General Meeting and has been under discussion at subsequent Council Meetings. To date little agreement has been reached on the clauses governing this class of membership, though a majority of members seem to be in support of the principle. It is still hoped that reconciliation of viewpoints can be attained.

Australian Medal of Agricultural Science

The fourth award of the Medal was made to Dr. E. A. Cornish, for his statistical contribu-

tions to agricultural research and to Australian agriculture, in particular for his survey of trends of wheat yields in South Australia. The Medal was presented at the Sixteenth General Meeting.

Finance

Income from subscriptions was about £60 lower than in 1950, although corporate membership increased by 122 and income could have totalled approximately £1000. Heavy increases in expenditure are due principally to the high cost of the Journal and to costs associated with Council and General Meetings. The lowered income and increased expenditure have converted a surplus of £463 for 1950 to a deficit of £143 for 1951.

If this rate of expenditure is maintained in 1952 the expenditure will be of the order of £1,200, which, with branch rebates of £790, will make the total expenditure £1,990. If membership remains unchanged and subscriptions are received with the usual lag, then income at the increased subscription rate will be of the order of £1,900, leaving a deficit for the year of £90.

On behalf of the Council,

J. G. DAVIES
President.

Membership

Corporate Membership

	N.S.W.	Vic.	Qld.	S.A.	W.A.	Tas.	A.C.T.
As at 31/12/50	218	206	86	104	95	31	58
Admissions	26	53	10	14	24	4	2
Transfer gains	3	9	1	1	—	1	3
Transfer losses	6	5	—	2	2	1	2
Resignations	2	1	1	—	—	—	2
Terminations	3	—	—	—	—	—	—
Deaths	—	—	—	1	—	—	1
As at 31/12/51	236	262	96	116	117	35	58

Total, all Branches, 920.

Student Membership

	N.S.W.	Vic.	Qld.	S.A.	W.A.	Tas.	A.C.T.
As at 31/12/50	96	14	21	25	43	—	—
Admissions	34	29	21	6	20	—	—
Cancellations, etc.	16	6	5	12	13	—	—
As at 31/12/51	114	37	37	19	50	—	—

Total, all branches, 257.

Institute Publicity

Members of the South Australian Branch were responsible for the articles published in a very successful newspaper Show Supplement, and thereby substantially increased their branch funds.

Qualifications Committee

During 1951 the Qualifications Committee, consisting of Dr. E. T. Edwards, Mr. F. S. McCleery and Professor J. R. A. McMillan, has continued to render a valued service to Council by its scrutiny of all applications for corporate membership.

FINANCIAL STATEMENTS

THE JOURNAL OF THE AUSTRALIAN INSTITUTE OF AGRICULTURAL SCIENCE

Statement of Receipts and Expenditure from July 1, 1950, to June 30, 1951

RECEIPTS				EXPENDITURE			
Brought forward	£108	4	4	Printing and Publishing Vol. 16, No. 1	£131	6	11
A.I.A.S. Subsidy	400	0	0	Printing and Publishing Vol. 16, No. 2	117	15	3
Advertising, Vol. 15, No. 3-4	11	3	0	Printing and Publishing Vol. 16, No. 3	150	4	10
Advertising, Vol. 16, No. 1	73	15	4	Printing and Publishing Vol. 16, No. 4	147	14	0
Advertising, Vol. 16, No. 2	57	13	2	Advertising Representative's Comm.	8	9	11
Advertising, Vol. 16, No. 3	60	2	4	Reprints	102	3	5
Advertising, Vol. 16, No. 4	63	13	9	Exchange		18	4
Reprints	80	11	7	Postage	15	5	3
Back Nos. and Volumes	7	4	1	Sundries	31	3	7
Subscriptions Vol. 16	19	1	9	Balance at Bank	207	18	8
Subscriptions in Advance	27	5	6				
Sundries	1	10	0				
Interest	2	15	4				
	£913	0	2		£913	0	2

Audited and found correct in terms of our Report dated September 14, 1951.

(Signed) CLEVELAND, SON AND HISLOP,
Chartered Accountants (Aust.).

THE AUSTRALIAN INSTITUTE OF AGRICULTURAL SCIENCE

Income and Expenditure Account for the year ended December 31, 1951

EXPENDITURE				INCOME			
Audit Fees	£15	17	0	Subscriptions:			
General Meetings	125	13	7	New South Wales Branch	£236	6	0
Council Meetings—Fares	80	10	6	Victorian Branch	238	17	0
Cost of Journal	625	10	6	Queensland Branch	88	9	0
Petty Cash and Incidentals	126	17	5	South Australian Branch	88	8	0
Printing and Stationery	18	8	4	West Australian Branch	131	5	0
Travelling—Prof. Willis	13	7	5	Tasmanian Branch	29	8	0
Legal Advice	12	12	0	A.C.T. Branch	64	1	0
Special Grant N.S.W. Branch	30	0	0	Bond Interest	28	12	6
				Net Deficit	143	10	3
	£1,048	16	9		£1,048	16	9

THE AUSTRALIAN INSTITUTE OF AGRICULTURAL SCIENCE

Balance Sheet at December 31, 1951

LIABILITIES			ASSETS	
Sundry Creditors	£263 5 9		Cash at Bank—	
Subscriptions in Advance	13 13 0		A.C..T	£548 5 10
Accumulated Funds—			Melbourne	284 7 5
Balance at 31/12/50 £1,612 18 9			Petty Cash	2 6 6
Deduct Net Deficit for Year Ended 31/12/51 143 10 3			Commonwealth Bonds	900 0 0
	1,469 8 6		Furniture at Cost	11 7 6
	£1,746 7 3			£1,746 7 3

THE REPORT OF THE AUDITORS

We have examined the above Balance Sheet. Figures relating to the cost of the Journal for the period from July 1, 1951, to December 31, 1951, have been incorporated from statements which have not been audited. Subject to this remark, we have obtained all the information and explanations we have required, and in our opinion, such Balance Sheet is properly drawn up so as to exhibit a true and correct view of the state of affairs of the Institute, according to the best of our information and the explanations given to us and as shown by the books of the Institute.

Canberra, March, 1952.
COOPER BROTHERS, WAY AND HARDY,
Chartered Accountants (Aust.).

EIGHTEENTH GENERAL MEETING

The Eighteenth General Meeting was held at C.S.I.R.O., Canberra on March 27, 1952, The President, Dr. J. G. Davies, was in the Chair and thirty five corporate members of the Institute including delegates from all branches attended.

General Business

The presentation of the Reports of Council* for 1951, and of the reports by the Honorary General Treasurer, the Honorary Editor and the Honorary Business Manager of the Journal was followed by some discussion. These reports were then adopted.

Amendments to Articles of Association to include Emeritus Members

Motions on Articles of Association to make provision for a class of emeritus members had been circulated to branches. Proxy votes cast were:

In favour of the motion	123
Against the motion	8

Accordingly, this class of membership will now be included in the Articles of Association. Minor amendments were made to the motions as circulated to Branches. In particular, it was agreed that such a member should be nominated by a Branch Committee, instead of having to make application to that Committee.

*Published elsewhere in this issue.

Report of Council on Australian Medal of Agricultural Science

The report of Council that Professor E. J. Underwood has been elected recipient of the Australian Medal of Agricultural Science for 1952 was adopted with acclamation. The medal was received on behalf of Professor Underwood by Mr. L. C. Lightfoot, who conveyed to the meeting, on behalf of the recipient, an expression of appreciation of the honour conferred.

Report of Council concerning the election of President

The report of Council that only the nomination of Professor E. J. Underwood for the office of President had been received and that he had been declared elected was adopted with acclamation.

In his absence, the Australian Capital Territory Branch President, Mr. C. S. Christian, was called on to take the Chair by the retiring President. The meeting expressed to Dr. J. G. Davies its appreciation of his service to the Institute during his term of office.

Presidential Address

Dr. J. G. Davies then delivered his presidential address* on "Pastures in the Australian Economy." At its conclusion the Chairman conveyed to Dr. Davies the thanks of the meeting.

*Published elsewhere in this issue.

COUNCIL PROCEEDINGS

A Council-in-Person Meeting was held at C.S.I.R.O., Canberra on Friday, 28th March, 1952.

Present

Mr. C. S. Christian (in Chair), Dr. I. Phipps (Vic.); Dr. S. L. Macindoe (N.S.W.); Mr. P. J. Skerman (Qld.); Mr. T. T. Colquhoun (S.A.); Mr. T. D. Raphael (Tas.); Mr. L. C. Lightfoot (W.A.); Mr. C. Neal Smith (A.C.T.); Hon. Editor, Mr. N. M. Tulloh; Hon. General Treasurer, Mr. A. V. Hill; Hon. General Secretary, Mr. G. A. McIntyre. Mr. W. M. Willoughby and Dr. C. Barnard attended as proxies for Queensland and Tasmania respectively.

Apology

The President, Professor E. J. Underwood, expressed regret that his duties made it impossible to attend.

Development of the Institute

Branch activity and rebates

The Treasurer drew attention to the fact that the cost of the Journal had risen considerably more than was anticipated and this applied also to the cost of reports, minutes, etc., on behalf of Council. Taken with a time lag in the collection of subscriptions at the new rate the deficit could be as high as £200 for the coming year.

Dr. Macindoe speaking for N.S.W. said that the branch funds were very low and even allowing for immediate rebates on subscriptions collected the branch would not be able to carry on without an advance to tide it over a difficult period. The branch expenses were heavy because of charges associated with hiring a hall and advices to members. The whole of the rebate scheduled for this year will be required. The possibility of income from other sources had been examined and the Sydney Morning Herald would consider the possibility of a supplement prepared by the branch next year.

Mr. Lightfoot said that with the increasing W.A. branch membership it was becoming necessary to have more and more work done by outside clerical services. The city rate inclusive of branch levy is now £3 and the country rate £2/10/0.

Mr. Colquhoun said that a supper levy of 1/6 is charged in the S.A. branch. A record of attendances at meetings is maintained.

Mr. Raphael said the Tasmanian branch could well use its rebate while Mr. Skerman for Queensland said the branch was well satisfied with the rebate arrangement and would soon be starting a newsletter service.

It was generally agreed that the accent should be on more activity at the branch level rather than reduced expenditure and that the rate of rebate should stand at least one year and preferably two to find how the scheme was working cut. In the meantime it may be necessary to draw on accumulated reserves.

The possibility of less frequent meetings of delegates as an economy measure was raised by Mr. Skerman who said the branch would raise the issue at the Sydney meeting. Representation of the branch by a visiting branch member other than the delegate at the meeting associated with ANZAAS or alternative delegate meeting was raised. The S.A. and W.A. delegates considered that the principal delegates should attend the meetings but agreed that any possible economy through combining with other business should be watched.

Journal

The Honorary Editor, Mr. Tulloh, reported that the Publications Committee recommended doubling the subscription rate for the Journal as from June. He assured the meeting that no difficulty would arise from raising the rate during the issue of a volume. At present the cost of publishing the Journal was higher than the subscription rate. At the doubled rate there would be a margin for a slight profit and for absorbing further rises in cost.

The following motion was carried—

> "That the subscription rates for the Journal be doubled and that the rates for Vol. 18, 1952 as from June be
>
> £1/1/0 Australia and New Zealand.
>
> £1/3/0 British Commonwealth.
>
> £1/5/0 Foreign.

Consideration was next given to the advertising position as revealed in the Annual Report of the Business Manager and to the lack of support by some branches in suggesting suitable topics for review articles. The following resolution was carried:—

> "That the action of the Business Manager in seeking advertising and of the Editor in seeking suggestions for review articles be commended and that branches be asked to co-operate fully in order to maintain and advance the Journal."

The Honorary Editor informed the meeting that he would have to resign after the June issue but would be able to help the incoming editor until the end of the year. Delegates expressed their regret at his coming resignation and their appreciation of the very considerable work he had put into the Journal.

A.I.A.S. Scholarship Scheme*

The meeting considered at considerable length the amendments to the draft rules put forward on November 7th and the response of the Sub-Committee to the amendments.

*It is proposed to publish in a future issue, a report on the Scholarship Scheme. This report will include such details as Rules, Finance Committee, Supervisory Committee and the establishment of the Scholarship Fund.

Rural Extension Services

The Secretary reported that reports from all branches except Queensland had now been received. Mr. Skerman (Qld.) said that the report had been drafted but had not yet been accepted by the branch committee. The received reports have been forwarded to Council's Sub-Committee for collation.

Agricultural Engineering

The Secretary reported that a report from Professor Willis containing recommendations to the New South Wales University of Technology had been circulated to branches. *Dr. Phipps* (Vic.) stated that a questionnaire on employment opportunities was being prepared by the Victorian Branch and would shortly be distributed. *Mr. Colquhoun* (S.A.) drew attention to the recent establishment in England of an Institute of Agricultural Engineering. *Mr. Skerman* (Qld.) commenting on the Willis Report said he favoured a civil or mechanical engineering course with a post graduate diploma in Agriculture, as it is easier to acquire subsequent to academic training the essential knowledge on the agricultural than on the engineering side. Vacations during the degree course should be spent on approved farms or agricultural colleges. Cadetship for lads with a farm upbringing should be considered. The schedule of a ten day preterm course in agricultural engineering to third year agricultural students given in Brisbane this year was made available to the meeting.

Affiliate Membership

The Secretary read a letter from *the President, Professor E. J. Underwood,* who expressed the opinion that the Institute should develop as a professional body with a view to obtaining a Royal Charter and status equivalent to that of certain other professional bodies. Standards must be strengthened. One alternative is to eliminate 4 (iii)*, another to eliminate 4 (iii) and include a new class of affiliates. Professor Underwood would rather see (4) (iii) retained than include this new class of membership.

Mr. Lightfoot, basing his remarks on a W.A. Branch Sub-Committee report, presented a case for examination for admission under 4 (iii). Other delegates doubted the necessity for such action feeling that the present screening by the branch, Qualifications Committee and Council were more than sufficient to ensure that members now admitted under 4 (iii) were equivalent to graduates in their field of work. *Dr. Macindoe* (N.S.W.) spoke of the system in N.S.W. where diplomates from an agricultural college were given five years experiment farm experience with two stiff grading examinations before passing out into extension work. Such a man is recognised by the Public Service Board as the equivalent of a graduate and he can become the head of a Division in which serve a proportion of graduates. In the circumstances the way should be left open for the men who have achieved professional standards to be admitted to the Institute.

*Clause 4 (iii) of the Articles of Association.

Dr. Phipps, speaking for the Victorian Branch, was concerned about 4 (iii) not because of the professional standard of persons who have been admitted under the clause but because of the effect the clause may have in establishing a case for a Royal Charter. It was agreed that the Secretary should seek information on whether the existing clause would be a serious obstacle to securing a charter.

Mr. Raphael (Tas.) introduced a new note with the idea that Affiliate Membership should be restricted to agricultural diplomates who after reaching a satisfactory standard of field experience should be admitted under 4 (iii) to corporate membership. This point of view did not receive support, other delegates favouring a more rigorous standard for 4 (iii) than was envisaged by Mr. Raphael and a broader basis for admission to Affiliate Membership. Majority opinion favoured retention of 4 (iii) and non-restrictive conditions for Affiliate Membership, the admission of individuals to be controlled by branch committees.

This matter will be further discussed at the Nineteenth General Meeting.

Interchange of Superannuation Rights

The Secretary stated that the replies of States, Commonwealth and Universities to the letter drafted by the Institute had been collated by the Standing Committee of Scientific Bodies and had been distributed to branches. While no positive action by the Institute was commended it was suggested that we recommend to the Standing Committee that it continue to press for uniformity.

Membership

The Secretary reported the receipt of the Annual Report of the Qualifications Committee, which was then read to the meeting. The Secretary was requested to convey to the members of the Committee the thanks of Council for their continued efforts in this important office.

Admissions

With the recommendation of the Branch submitting the application and the Qualifications Committee the following applications were approved for **Corporate Membership**—

Butler, R. M.	Victoria
Cameron, N. G.	,,
Edmonds, J. W. E.	,,
Elvery, D. H.	,,
Jardine, R.	,,
Mitchell, A.	,,
Taylor, C. R. H. (Miss)	,,
Robinson, B. de C.	,,
Webster, A.	,,
Fox, N. F.	Queensland
Galletly, J. C.	,,
Coaldrake, J. E.	,,
Russell, R. F.	New South Wales
Murphy, M. (Miss)	,,
Myers A. M. (Miss)	,,
Martin, G. J.	Tasmania
Cock, R. E.	,,
Frankel, O. H.	Australian Capital Territory

Of two nominations under Clause 4 (iii) referred to Council by the Qualifications Committee, one was refused and the other accepted.

Student Membership

Acting on the recommendation of the Victorian Branch, Mr. P. G. Shelden was admitted to **Student Membership.**

Resignation

The resignations of Dr. K. L. N. Key, Australian Capital Territory Branch and Mr. W. Angus, South Australian Branch, were accepted by Council with regret.

Acting on the recommendation of the New South Wales Branch, Council terminated the membership of J. D. Bull, T. Gould and R. I. Johnson, all of whom are unfinancial.

Transfers

Dr. I. Molnar, Australian Capital Territory to Victoria.
Mr. A. W. Stewart, New South Wales to Victoria.
Dr. R. Swaby, New South Wales to South Australia.
Mr. E. Munch-Petersen, Victoria to Western Australia.
Mr. J. W. Berryman, Victoria to Tasmania.
Mr. D. B. Williams, South Australia to Australian Capital Territory.

Cancellation of Student Membership

New South Wales

Briggs, P. K.
Condon, T. F.
Cook, E. R. H.
Cranston, J. S.
Harland, C. W. E.
Kingham, I. A.
McHugh, L. J.
Mears, A. D.
McPhillips, J.
Philpotts, H. (Miss)
Peterson, A. S.
Ridge, R. H.
Roberts, E. H.
Walker, P. H.
Parish, R. McD.
Barrie, J. W.
Frazier, A. K.
McFarlane, J. D.
Mills, W. C.
Harris, R. W.
Saville, S. P.
Vane, N. W.

Victoria

Butler, R. M.
Cameron, N. G.
Edmonds, J. W. E.
Elvery, D. H.

Queensland

Fox, N. F.
Galletly, J. C.
Hartridge, F. J.
Huybers, E. F.

Australian Scientific Research Index

The Secretary to the Australian National Research Council Committee on Scientific Information requested the opinion of the Institute on the value of an "Australian Scientific Research Index". This Index would be published at monthly intervals and would consist of references without abstracts and would cover journal articles and irregular publications and possibly new books, departmental annual reports, etc. Views expressed by the meeting were that the index would not be of use to the Institute although it may be of value to individual members. It may be of more value as a reference to future rather than present workers. Its immediate value would be to Indexing Agencies overseas. The Secretary was asked to convey these views to the Australian National Research Council.

Subscription of Emeritus Members

Following the adoption by the Eighteenth General Meeting of the Amendments to the Articles to create Emeritus Membership the following motion was carried—

"That the subscription rate for emeritus members for 1952 be one guinea."

Pamphlet on "Agricultural Science as a Career"

Dr. Phipps reported that good progress had been made towards the preparation of this production and it would be submitted to branches for comment and amendment.

BRANCH NOTES

Australian Capital Territory

The members of the Branch Committee for 1952 are as follows:—

President and Principal Delegate—Mr. C. S. Christian.

Honorary Secretary—Mr. C. A. Neal-Smith.

Honorary Treasurer—Mr. E. F. Biddiscombe.

Honorary Sub-Editor—Mr. T. G. Campbell.

Committee Member—Mr. F. O. Grogan.

The Annual General Meeting of the Branch was held at C.S.I.R.O. on March 14, when the retiring President (Mr. P. A. Reid) delivered his presidential address entitled "The South African Wool Industry".

A film evening was held on February 27, when a programme of short documentary films was screened, the principal one of which was "The Valley is Ours", an Australan production dealing with the Industries of the Murray Valley.

A meeting, held on May 12, took the form of a question evening on the subject "Trace Elements in Plant Nutrition." A panel of speakers (Messrs. A. J. Anderson, K. D. McLachlan and D. Spencer) answered questions which had been submitted prior to the meeting.

New South Wales

The main business of a general meeting held at Science House on 16th October, 1951, was an address by Mr. G. E. Ramsay on "The Development of the Water Resources of the Snowy Mountans". Mr. Ramsay is Public Relations Officer of the Snowy Mountains Authority.

The history of the Snowy Mountains Scheme goes back to the first proposals for making use of the Snowy waters which were put forward over seventy years ago. The beginning of effective action came in 1946 when representatives from the Commonwealth, New South Wales and Victoria met to discuss the matter from a national viewpoint. Technical reports were presented in 1948 and 1949 and work actually began in 1949 after the Snowy Mountains Hydro-Electric Authority was formed by act of Parliament.

Mr. Ramsay then outlined the plans for the construction of the various dams and power plants. This portion of the talk was illustrated by a series of coloured slides showing aspects of the work in progress, machinery used and the nature of the country.

The address was followed by questions and discussion from members and visitors.

The 17th Annual General Meeting of the Branch was preceded by a buffet tea during which, Prof. R. D. Watt, first President of the Branch, and Mr. C. McKerihan, President of the Rural Bank, spoke informally.

The following office bearers were elected for 1952:—

President—Dr. K. O. Campbell.

Vice-President—Dr. S. L. Macindoe.

Honorary Secretary—Mr. P. G. Valder.

Honorary Treasurer—Dr. E. P. Baker.

Committee Members—Mr. E. J. Breakwell.
—Mr. W. A. Horsley.
—Mr. K. L. Green.

Honorary Sub-Editor—Mr. S. M. Sykes.

Honorary Business Manager—Mr. C. H. Macphillamy.

The retiring President, Dr. S. L. Macindoe, delivered an illustrated address entitled "Some crop and pasture investigations in New South Wales".

Queensland

The Annual General Meeting was held on March 19. The office bearers elected for 1952 are:—

President—Mr. P. J. Skerman.

Vice-Presidents—Mr. W. W. Bryan and Mr. N. E. H. Caldwell.

Honorary Secretary Treasurer—Mr. G. H. Allen.

Honorary Assistant Secretary-Treasurer—Mr. K. J. Hutchinson.

Honorary Sub-Editor—Mr. C. W. Winders.

Committee Members—Dr. W. A. McDougall, Dr. N. T. M. Yeates, Mr. R. F. Langdon.

The report of the Branch Committee for 1951 revealed cash assets of approximately £60 and a membership of 1 honorary, 95 corporate and 37 student members.

In his Presidential Address on "Usage of Agricultural Chemicals in Queensland", Mr. N. E. H. Caldwell surveyed the production, distribution and use of pest destroyers, weedicides and growth-regulating substances in the State.

It was estimated that the initial charging of cattle dips calls for 290 tons of arsenic trioxide, 56 tons of para-para isomer DDT and 4.2 tons of gamma isomer BHC, and that an average of 90 tons of DDT alone is used against sheep blowfly.

The spectacular rise to 1,350 tons in the use of BHC for cane grub and wireworm control was commented upon, and mention made of the fact that some ten million thallium sulphate rat baits are used annually by cane growers.

The use of selective weedicides is increasing rapidly, and under the Lands Department's concession scheme some 10,000 gallons of concentrated hormone preparations are distributed each year.

Mr. Caldwell detailed difficulties of distribution caused by the unreliability of transport services, both inter-and intra-State, and the distance of many retailers from centres of bulk storage.

In conclusion, the view was expressed that, despite advances in incorporating pest and disease resistance into plant varieties and strains of animals, a large expansion in the use of agricultural chemicals would occur within the next ten to twenty years.

At the April meeting, Dr. Lincoln Ellison, range ecologist in the United States Forest Service, gave an illustrated talk on "Plant Succession and Soil Development on the High Plateaux of Utah." Assisted by colour transparencies, Dr. Ellison took his audience from the desert country of Utah, used for winter grazing by sheep and cattle, to the foothill country where the sheep and lambs are shorn in the spring, then to the higher aspen, oakbrush, sagebrush and sub-alpine zones, which are under snow in the winter and are used only for summer grazing.

The primary succession in dry, exposed situations on the uplands was traced from bare rock through to the herbaceous climax vegetation. In the first stage, spruce and fir trees creep in among the broken rocks. As shrubs and tall herbs come in, soil is developing contemporaneously, and by the time the herbaceous stage is reached the soil is fairly free of rocks.

Pastoral occupation of Utah induced secondary successions following two main trends. On sheep range, the trend is towards dominance by grasses, particularly *Stipa lettermani*. Sheep prefer the herbs to the relatively unpalatable stipa. Cattle, on the other hand, prefer grasses to herbs, and sweet sage, geranium, dandelion, etc. increase under heavy grazing.

Grazing too heavily by any kind of stock tends to reduce the original mixed upland

herbaceous climax to bare ground with ephemerals, but usually intermediate communities of perennial species become more or less stabilized.

Dr. Ellison said that the main problem of the land manager is to be able to recognize the causes of soil and vegetation changes. It is the duty of the ecologist to determine normal conditions and the causes and signs of deviations from the normal. While much has been achieved in the Rocky Mountains region, it is obvious that land management under grazing conditions will always need to be kept under the eye of the ecologist and cannot be reduced to any simple formula.

The Branch is organising a public meeting, to be held on July 23, at which an address will be given by Mr. A. F. Bell, a former President of the Institute. His Excellency, the Governor of Queensland (Sir John Laverack) has consented to attend the meeting, and a number of distinguished citizens are to be invited.

South Australia

An unusually frank and delightful address was given at the Annual General Meeting of the South Australian branch on March 14, by the visiting Director of Science Services in the Canadian Department of Agriculture (Dr. K. W. Neatby). To make way for this, the presidential address of the retiring president (Mr. T. T. Colquhoun) was deferred until later.

Dr. Neatby outlined Canada's agriculture and the associated problems of agricultural research and its administration.

He said primary production in Canada was chiefly related to four industries: agriculture, forestry, mining and fisheries. It was difficult to decide which of these was most important. A commonly misunderstood feature of Canada was its geography. The much publicised prairies formed only a small bite out of the bottom and agriculture was confined to a narrow region in the south-west, the south-east and along the United States border.

Separating east and west was 1,000 miles of "no man's land", cold and snowbound with only scrubby forests. This formed an unfortunate social barrier between east and west.

Canadian agricultural research was dominated by the Department of Agriculture, a not entirely satisfactory state of affairs. Agriculture faculties had been set up at many of the western universities at the time of foundation, and these had taken their place alongside other faculties so that a high standard had been maintained. But many eastern universities were without a faculty in agriculture and many of those with one, restricted their activities to teaching.

Some universities had made considerable contributions to agricultural research, but, by virtue of heavy teaching loads, others had done little.

Of agricultural education, Dr. Neatby said a good man would rise to the top despite the system, but, for agricultural research, he thought the best system was to encourage honours graduates in science to specialise in agriculture.

At the Annual General Meeting, the following office bearers were elected:—

President—Dr. R. N. McCulloch.

Vice-President—Mr. T. T. Colquhoun.

Honorary Secretary—Mr. V. K. Lohmeyer.

Honorary Treasurer—Mr. A. J. K. Walker.

Honorary Sub-Editor—Mr. J. W. Ryan.

Committee Members—Dr. H. G. Andrewartha, Dr. N. T. Flentje, Mr. D. S. Riceman, Mr. J. A. Beare.

Institute members regaled themselves at a social evening held at Waterfall Gully on February 22. Visitors included Professor G. C. Hanna, American vegetable expert from Davis University, California, and Dr. Pavlychenko, Canadian weeds expert. Dr. Pavlychenko gave an interesting address on the place and function of the Canadian equivalent of the Institute of Agricultural Science. (The Agricultural Institute of Canada.).

Tasmania

The Sixteenth Annual General Meeting of this Branch was held in Hobart on March 3, 1952. The following office bearers were elected:—

President—Mr. T. D. Raphael.

Vice-President—Prof. H. N. Barber.

Honorary Secretary—Miss E. G. Wingrave.

Honorary Treasurer—Mr. D. S. Thompson.

Honorary Sub-Editor—Mr. E. J. Martyn.

Publicity Officer—Mr. N. M. Hudson.

Committee Members—Mr. G. C. Wade, Mr. W. F. Walker.

After the business of the meeting had concluded, members adjourned to the Imperial Hotel for the Annual Dinner which was held this year after a lapse of several years. There was a good attendance of 19 members and visitors. Following the dinner the presidential address was given by the retiring president, Mr. Wade. It was entitled "Recent Trends in Plant Pathology."

The 51st General Meeting of the Branch was held March 24. The main business of the meeting was to instruct the Principal Delegate on branch views for presentation at the Council meeting on March 28. The Scholarship Scheme and Classes of Membership were discussed at some length.

It was agreed at this meeting that branch meetings should be held on the topic of means of increasing food production in Tasmania.

Victoria

On 29th February 1952, a joint address on "The Organization of Agricultural Advisory Services" in their respective countries was given by Sir William Slater, Secretary of the Agricultural Research Council of the United Kingdom, and Dr. K. W. Neatby, Director, Science Service, Department of Agriculture, Canada.

On 14th March 1952 the Branch held a joint meeting with the Institute of Food Technologists. A large audience heard Prof. G. C. Hanna, University of California, advancing "Some Ideas

on the Production and Quality of Vegetables in Australia."

The Annual General Meeting of the Branch was held on 4th April 1952. The meeting expressed satisfaction with the level of branch activity maintained during the year and discussed the future of the Branch and the Institute. The following motion was carried: "The Victorian Branch wholeheartedly supports its Committee's efforts to attain the ultimate goal of a central secretariat with a permanent General Secretary and directs it to continue to work to achieve this objective."

The Committee elected for the ensuing year consists of:—

President—Mr. L. R. Hoult.

Vice-President—Mr. R. G. Downes.

Immediate Past President—Dr. I. F. Phipps.

Honorary Secretary—Mr. J. A. Roberts.

Honorary Treasurer—Mr. W. B. C. Mackie.

Honorary Assistant Secretary—Mr. R. O. Kefford

Honorary Sub-Editor—Mr. H. G. Turner.

Committee Members—Dr. H. C. Forster, Mr. J. K. Gaunt, Mr. R. D. Croll, Mr. L. L. Stubbs.

Miss Irene Stewart, in whose hands the Branch Newsletter has become a valuable feature of the corporate life of the Branch, has agreed to continue in her position as Honorary Recorder.

The Institute sponsored speakers to address the Annual Convention of the Victorian Chamber of Agriculture, which was held in South Melbourne from 22nd to 24th April. The theme of the Convention was Production Potentials for Victoria's primary industries. The speakers supplied by the Institute were Messrs. R. W. Spicer (Horticulture), T. S. Bellair (Dairying), W. A. Beattie (Beef) and C. G. Webb (Cereals).

Western Australia

An ordinary general meeting was held on the 29th February when members were addressed by Dr. T. K. Pavlychenko, Director of Agricultural Research with the American Chemical Paint Co. (U.S.A.) Dr. Pavlychenko spoke on "Modern Methods of Weed Control" and outlined the development of weed research from 1930 up to the present day.

At the ordinary general meeting held on the 11th March the guest speaker for the evening Mr. C. M. Donald, of C.S.I.R.O., delivered an address on "Mediterranean Agriculture."

Mr. Donald explained that he was one of a team sent to the Mediterranean area in an endeavour to obtain collections of plants which might be suitable for agricultural purposes in Australia. The speaker discussed the agricultural practices in the various countries visited and supplemented his remarks with a series of excellent colour film strips.

The ordinary general meeting held on the 7th April was well attended by members who gathered to congratulate Professor E. J. Underwood on the occasion of his receiving the Australian Medal of Agricultural Science for 1952. Dr. G. A. Currie formally presented the medal and outlined the distinguished contributions to agricultural science made by Professor Underwood.

Later in the evening, Dr. Currie, who is leaving this State to take up the position of Vice-Chancellor of the University of New Zealand, delivered a farewell address entitled "Malthus was Right," and outlined certain important aspects of food production in various countries throughout the world.

The Annual General Meeting was held in Perth on 5th May. Office bearers elected for 1952 were:—

President—Dr. R. Smith.

Vice-President—Mr. A. J. Millington.

Honorary Secretary—Mr. C. A. Parker.

Honorary Assistant Secretary—Mr. R. F. Doepel.

Honorary Treasurer—Mr. P. N. Forte.

Honorary Sub-Editor—Mr. D. K. Giles.

Committee Members—Mr. M. Cullity, Mr. A. W. Humphries, Mr. S. T. Smith, Mr. E. Munch-Petersen.

Mr. L. C. Lightfoot as immediate Past President is also, *ex officio*, a member of the Committee.

The Business session was adjourned for a buffet tea and a number of visitors were welcomed by members. The retiring President Mr. L. C. Lightfoot then delivered his presidential address entitled "The People, The Farmer and the Agricultural Scientist."

PERSONAL NOTES

Australian Capital Territory

Dr. O. H. Frankel, who was recently appointed Chief, C.S.I.R.O., Division of Plant Industry, has now completed his first visit to most of the Regional Laboratories and Field Stations of the Division. The centres visited were Perth, Kojonup, Adelaide, Deniliquin, Armidale, Trangie, Brisbane, Lawes and Stanthorpe. While on these visits Dr. Frankel called on the Departments of Agriculture and University Departments of Agriculture and Botany. In Western Australia, South Australia and Queensland he addressed meetings of the State Committees of C.S.I.R.O.

Dr. B. T. Dickson, former Chief, Division of Plant Industry, C.S.I.R.O., represented C.S.I.R.O. at the Arid Zone Conference held in Turkey in April. This Conference was held under the auspices of U.N.E.S.C.O. The other Australian delegate was Professor E. S. Hills, Professor

of Geology at the University of Melbourne. At the conclusion of the Conference in May, Dr. Dickson participated in a symposium entitled "Conquest of the Desert," held in Israel.

Mr. J. N. Lewis, of the Bureau of Agricultural Economics, has been awarded a Commonwealth Fund Fellowship tenable in the United States for twelve months for post-graduate study in the fields of public administration and agricultural economics. Mr. Lewis intends to leave Australia early in August.

Mr. J. H. E. Mackay, research officer of the Division of Plant Industry, recently spent six weeks in New Zealand visiting institutions carrying out research in Plant Pathology with special reference to anti-biotics.

New South Wales

Mr. H. Wenholz, former Deputy-Chief of the Division of Plant Industry in the New South Wales Department of Agriculture, recently retired after a long period of service in plant breeding. He was one of the first graduates in agriculture from the University of Sydney.

Mr. C. R. Wallace has resigned from the New South Wales Department of Agriculture to join the Commonweaalth Institute of Entomology in London.

Miss M. D. Penny has rejoined the staff of the University of Queensland after returning from England.

Mr. R. G. H. Barbour has joined the staff of the University of Technology as Lecturer in Microbiology.

Dr. N. H. White, Senior Lecturer in Agricultural Botany at the University of Sydney, has been awarded a Carnegie Grant and leaves for the U.S.A. in August.

Mr. J. Shipton has been appointed to the position of Chief Food Technologist with the Department of Commerce and Agriculture, and will be stationed in Melbourne. He was formerly a research officer with the Division of Food Preservation and Transport, C.S.I.R.O.

Dr. E. T. Edwards, formerly Agricultural Editor with National Press Pty. Ltd., Sydney, is now with the firm of Houghton and Byrne Pty. Ltd.

Two members of the New South Wales Branch are recovering from serious illnesses—*Mr. T. McCarthy*, Chief Entomologist, and *Mr. J. G. Carroll*, Agronomist, both in the New South Wales Department of Agriculture.

Miss Helen Wrigley, former Secretary of the Branch, has recently returned from her trip abroad.

Mr. F. W. Hely has been awarded the Degree of M.Sc.Agr. at the University of Sydney. He is at present overseas and recently left the U.S.A. for Europe, where he plans to spend some time in Belgium.

Mr. J. D. Colwell, soil chemist in the New South Wales Department of Agriculture, has been awarded a Walter and Eliza Hall Fellowship for 1952. He will study at the McCauley Institute in Edinburgh for a period of about two years.

Queensland

Mr. G. D. Hubble, regional officer in charge of C.S.I.R.O. soil surveys in Queensland, left in March on an official overseas tour embracing Hawaii, the U.S.A., the Caribbean region, Northern Africa and the United Kingdom.

Mr. E. B. Rice, Director of Dairying in the Queensland Department of Agriculture and Stock, recently spent two months in Pakistan examining milk production and processing. The visit was made on behalf of the Commonwealth Government under the Colombo Plan.

Dr. H. E. Young, who left Queensland three years ago to join the Rubber Research Scheme (Ceylon) as Oidium Research Officer, is spending his furlough in Queensland. Dr. Young will take up appointment as Director of the Scheme on his return to Ceylon.

Mr. E. F. Henzell, a student member of the Institute, has been awarded a Rhodes Scholarship.

The following appointments and changes have taken effect in recent months—*Miss J. Campbell*, as Junior Lecturer in Agriculture in the University of Queensland; *Mr. E. C. Tommerup*, as Senior Lecturer in Plant Industry, Queensland Agricultural High School and College; *Mr. J. A. Weddell*, as Technical Administration Officer, Division of Plant Industry, Department of Agriculture and Stock; *Mr. S. A. Waring*, as Lecturer in Agronomy, University of Queensland; *Mr. B. R. Champ* as Assistant to Entomologist, Department of Agriculture and Stock; *Messrs. F. H. Bollman, N. F. Fox, J. B. Ritson* and *R. S. Wetherall* as Assistant Agrostologists, Department of Agriculture and Stock; *Mr. F. G. Kieseker* as Assistant Bacteriologist, Department of Agriculture and Stock.

South Australia

Mr. M. V. Carter, formerly an honours genetics student at the Waite Institute, has been appointed as a research officer in the Division of Plant Industry, C.S.I.R.O., Canberra.

Mr. W. E. Matheson and *Mr. A. L. Clark* have been appointed Soil Conservation Officers in the Department of Agriculture.

Mr. P. N. Byrne has been appointed as a dairy research officer in the Dairy Branch of the Department of Agriculture.

Tasmania

Two members of the staff of the Agronomy Division, Department of Agriculture, have been recently admitted to the Institute as corporate members. They are *Messrs. R. E. Cock* and *G. J. Martin*.

Mr. Cock, who is a B.Sc. (Leeds), is mainly concerned with weed control problems, while Mr. Martin, a Melbourne graduate in Agricultural Science, is working on pasture problems.

Victoria

Mr. J. W. Berryman, formerly Horticultral Research Officer at Swan Hill, has transferred to the Tasmanian Department of Agriculture.

Mr. A. W. Stewart has transferred from New South Wales to Victoria. He is General Manager of the British Metal Corporation (Aust.) Pty. Ltd.

Mr. J. Kendall has resigned from the Horticultural Division, Department of Agriculture, to take a position as Agricultural Scientist at the Museum of Applied Science, Melbourne.

Mr. R. Jardine, Biometrician of the Department of Agriculture, has returned after completing two years advanced training in the Statistics Laboratory, University of Cambridge.

Western Australia

Dr. G. A. Currie has resigned from the position of Vice-Chancellor of the University of Western Australia to take up an appointment as Vice-Chancellor of the University of New Zealand.

Dr. R. Smith, Senior Research Officer in the Division of Soils, C.S.I.R.O., stationed at the Institute of Agriculture, University of Western Australia, gained his D.Sc. (Agric.) this year for his work on the "Soils of the South-West Agricultural Region of Australia."

OBITUARY

Ralph Duddington Wilson

It is with deep regret that we record the death, on 13th March, 1952, of Mr. R. D. Wilson, Plant Pathologist in the New South Wales Department of Agriculture.

Mr. Wilson joined the Department as a trainee in 1928 and was appointed to the Biology Branch in 1932. After a brilliant career at the University of Sydney, he graduated in Agriculture with first class honours and the University Medal. He was awarded the degree of M.Sc. Agr. in 1936. In 1935 he proceeded to the University of Wisconsin as a Walter and Eliza Hall Fellow and received the degree of M.S. in 1937. Before returning to Australia, he travelled extensively in the U.S.A., Great Britain and Europe visiting agricultural research institutions.

His professional work was devoted mainly to investigations on the diseases of vegetable crops. His studies on the diseases of beans are well-known and his research on diseases caused by a soil deficiency of molybdenum was of high merit. This work has resulted in a clearer knowledge of the cause and control of such diseases as whiptail of crucifers, bean scald and chlorosis diseases of tomatoes, rockmelons and lettuce. Bean growers will remember Mr. Wilson for the part he played in the organization of the New South Wales Bean Seed Certification Scheme for the control of halo blight and anthracnose of beans.

With the untimely death of this able and experienced member, the profession of agricultural science in Australia has indeed suffered a serious loss.

Ernest Breakwell

Members will learn with profound regret of the death of Mr. E. Breakwell, a former President of the New South Wales Branch. Mr. Breakwell was born in 1885 and was the first agrostologist in the New South Wales Department of Agriculture which he joined in 1914. In 1922 he began his work in agricultural education and it was in this field that he became best known. He became the first headmaster of Yanco Agricultural High School and later was appointed as an inspector of schools. The New South Wales Junior Farmers' Clubs owe much to Mr. Breakwell who was one of the founders of the movement and was elected President of the State organization in 1950.

The State and the Institute have lost an outstanding agricultural educationist in Mr. E. Breakwell. He is survived by Mrs. Breakwell, two daughters and a son, Mr. E. J. Breakwell, who is well-known in Institute circles and also a former President of the New South Wales Branch.

BOOK REVIEW

AGRICULTURAL COOPERATION IN THE COMMONWEALTH

By MARGARET DIGBY

(Basil Blackwell, Oxford, 1951, 172 *pp.,* 15/- *stg.)*

Australia has quite a history of agricultural cooperation. The early attempts at cooperation in the dried fruits and other industries about 1900 are fairly well known as also are the difficulties imposed by the Constitution in making cooperation legally binding on all members of the industries concerned.

It is remarkable to find that a somewhat similiar evolution of agricultural cooperatives has taken place during the last fifty years or more in most countries. We find the same concern about the middleman, the same problems with the uncooperative minority, the same increasing government intervention in marketing.

This book explains how agricultural cooperatives spread through the British Commonwealth in a comparatively short time amongst people of diverse race, social custom and living conditions.

Beginning mainly as a native product amongst industrial workers in Britain about 1850, the cooperative movement spread to European countries, Canada, Australia and elsewhere. Farmers adopted it both for the purchase of their agricultural requirements and for the disposal of their products. It is interesting that the movement often grew amongst farmers following some revolution in the technique of production, e.g., the cooperative creameries set up in Victoria in 1889.

This book is easy to read and will be fruitful for those who see in the cooperative movement an alternative to private, collective or state enterprize. It will be also valuable for those concerned with the organization or administration of marketing schemes in which farmer cooperation plays some part.

A. J. McINTYRE.

NEWS ITEMS

The Bread Research Institute of Australia

The Bread Research Institute was established by the Bread Manufacturers of New South Wales in 1947, its activities having spread to all the other Australian states in the ensuing five years. The Institute has recently completed negotiations for its recognition as a research association by C.S.I.R.O. whereby it will receive a governmental grant to assist its work. This will be made for a period of five years, in the first instance, under similar conditions to those under which research associations in the United Kingdom receive assistance from the Department of Scientific and Industrial Research.

The work of the Institute is concerned with the provision of an advisory service, the investigation of technological and applied problems arising in the industry and the carrying out of fundamental research.

The Institute's laboratories are at 111 Pacific Highway, North Sydney, and the Director is Mr. E. E. Bond.

Australian Society of Animal Production

In Queensland, New South Wales and Victoria, discussions of the possibility of forming an Australian Society of Animal Production have come to fruition to the extent that societies are now functioning in each of these states. It is envisaged that they will ultimately be constituted to form a federated organization. The primary aim of the Society is to facilitate discussion of problems of animal production and personal contact between the various workers in this field.

Institute of Food Technologists

The second convention of the Institute of Food Technologists—Australian Regional Section—will be held at Hawkesbury Agricultural College, Richmond, New South Wales, on July 2-4, 1952. A comprehensive programme, which includes a symposium on "Agricultural raw materials for food industries", has been arranged.

The sessions are not restricted to members of the Institute of Food Technologists. Those interested may contact Dr. V. M. Lewis, 25 Byron Street, Coogee, N.S.W.

Pastoral Research and Training Institute to be established

An institute for pastoral research and training is to be established on a 24,000-acre property in the Jerilderie district of New South Wales. The property has been set aside for this purpose by Messrs. Roy and Samuel McCaughey, of Wagga and Coonong, in memory of a son and nephew who lost their lives in World War II.

The chairman of the McCaughey Trust, Sir Henry Manning, M.L.C., stated that the station would be run as a commercial enterprise for the present, and the income would be used for the gradual development of research and educational activities. A technical committee, which will include several members of the staff of Sydney University, will be appointed to advise the Trust on the development of the Institute's scientific activities. The Vice-Chancellor of the University, Professor S. H. Roberts, said that the bequest was one of the most important developments in veterinary education since the establishment of the veterinary school at the University.

Appearance of new plant diseases

The occurrence of the following diseases of cucurbits, rhubarb and potatoes has been recorded for the first time in New South Wales (*Agr. Gaz. N.S.W. LXIII*, 2, *Feb.*, 1952, *p.*89):—

Cucurbita maxima (Pumpkin).—*Colletotrichum lagenarium* (Pass.) Ell. and Halst (anthracnose); Murrumbidgee Irrigation Areas.

Cucurbita maxima, C. pepo (Pumpkin, marrow and squash).—*Fusarium soloni* App. and Wr, F. cucurbitae Snyder and Hansen (Foot rot and wilt); North Coast (old record), metropolitan area.

Rheum rhaponticum (Rhubarb).—*Agrobacterium tumefaciens* (E.F. Sm. and Town). Conn (Crown gall); metropolitan area.

Solanum tuberosum (Potato).—Big bud virus (Purple top wilt); Grafton.

Synthetics for improving soil structure

We have long known the practical methods for improving soil structure. The simplest treatment is flocculation, which can be caused by gypsum or lime. However, granulation, or binding the soil into water-stable aggregates, is more than flocculation, and this is commonly achieved by adding organic matter in some way, either by growing a good pasture or by digging in bulky products, green manure or animal manure. On the theoretical side we have supposed for some years that a minor colloidal fraction of this organic matter was responsible for forming crumbs or other aggregates out of the inorganic matter. Many of us must have thought, "Why not develop a synthetic glue that will form the crumbs without all the trouble and inefficiency of the bulky manures?" We have probably dismissed the thought because of the expense. Yet if the synthetic glue could last for many years it might rival the traditional methods in terms of cost as well as convenience.

It has now been claimed that such a synthetic has been made, under the trade name of "Krilium." Whatever may be the value of this particular substance (and this is now under test in various official stations in America), there is no doubt that synthetic structure-formers will be with us from now on. They will be interesting, both practically and theoretically. On the

practical side, the present cost of "Krilium" is prohibitive for farming over broad acres, but may still allow its use in small areas, such as greenhouses. Further, it is often important to start growth quickly on a small patch of clayey subsoil that is open to erosion by the rain, whether it has been exposed by earlier erosion or by deliberate earthmoving. A synthetic structure-former can give the right physical conditions for immediate germination and growth, while we might have to wait years for the old-fashioned microbes to bring about the same degree of aggregation from rotting manures. From what we are told it appears that the substance is the sodium salt of a polymer of acrylic acid. That is, ideally the molecules consist of very long chains, with the pattern continually repeated:

$$—CH_2——CH(COOH)——CH_2——CH(COOH)—$$

(The exact constitution is not known).

The carboxylic tags make the molecule soluble in water, though they are actually fewer than here pictured. It is strange that a negatively charged molecule like this should bind together the clay particles which are also negatively charged. This effect is said to depend on the anion exchange capacity of the clay—that is, on its more positive spots where groups of :FeOH and :AlOH are exposed. While this subject is still unexplored, the effect is analogous to that of the microbial gums which are also negatively charged. The idea seems to be that the composite particles are able to reach the desirable size of ¼ mm. by the mutual action of the soil cations, clay, silt, and synthetic polymer. If we can thus create good and stable structure without biological complications, our studies of this product should give us much better understanding of the good structure which some soils have naturally, and of how this can be maintained.

Farrer Memorial Medal, 1952

Dr. B. T. Dickson, recently retired Chief of the Division of Plant Industry, C.S.I.R.O., Canberra, has been awarded the Farrer Memorial Medal for 1952. He will deliver the Memorial Oration during the Annual Conference of the Agricultural Bureau next July at Hawkesbury Agricultural College.

Making this announcement in Sydney, Dr. R. J. Noble, Under Secretary and Director of the N.S.W. Department of Agriculture, and Chairman of the Farrer Memorial Trust, said that the award not only served to perpetuate the memory of William Farrer, but enabled the Trust to honour those who had rendered distinguished service in agricultural science.

Dr. Dickson is a graduate of Queen's University, Ontario, Canada, and subsequently undertook post-graduate work at Cornell University, U.S.A. He was on active service in France for three years during the 1914-1918 war. Subsequently, he was appointed Professor of Economic Botany at McGill University, Canada, and in 1927 he came to Australia to take up the newly established position of Chief of the Division of Plant Industry, C.S.I.R. He organised the research work of the Division in agrostology, plant genetics and plant pathology. Material expansion in some of this work has occurred during recent years as a result of its association with problems in wool research.

Dr. Dickson was foundation president of the A.C.T. branch of the Australian Institute of Agricultural Science and became President of the Institute in 1945.

He was a member of the Australian Delegation at the Food and Agriculture Organisation Conference at Copenhagen in 1946.

Dr. Dickson visited Paris, December, 1949, at the invitation of UNESCO Division of Natural Sciences to join with a group of specialists to advise on establishment of an international laboratory devoted to studies of arid zone problems. At the present time he is visiting Turkey and Israel for discusions on arid zone pasture and herbage management problems.

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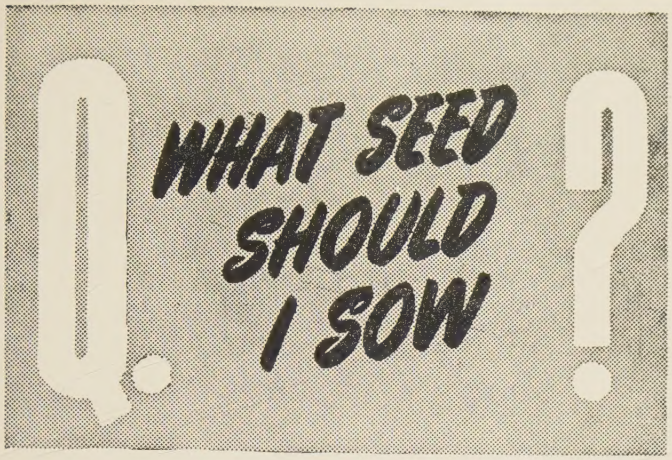

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